ENGINEERING AND MINING JOURNAL

JUNE 1959

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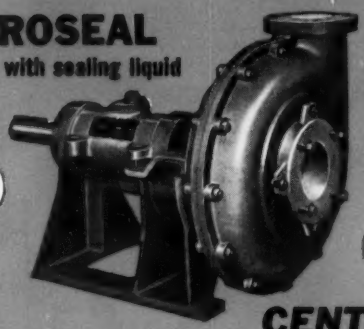
Engineered pumping of

abrasives
corrosives
acids

INTERCHANGEABLE

HYDROSEAL
operates with sealing liquid



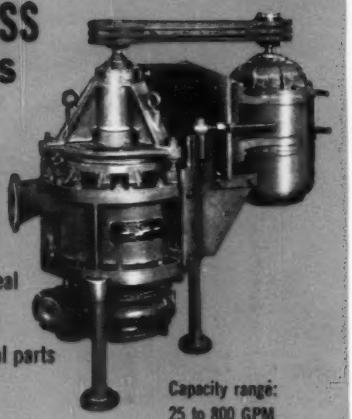
Split-Shell SLURRY and SAND Type
2" to 14"

Brochure No. 457

Brochure No. 557

CENTRISEAL
delivers the pulp undiluted

PACKLESS Pumps



No stuffing box
No packing
No mechanical seal
No liquid seal
No exposed metal parts

Capacity range:
25 to 800 GPM

Brochure No. 857

Flex-Check Valves
RUBBER-LINED

For pipe diameters up to 12"
For solids up to ¼"

Brochure No. 957

RUBBER-LINED PUMPS

HYDROSEAL
VERTICAL
sump pump

Brochure No. 757

RUBBER-LINED or ALL-METAL
Four sizes: 1½" to 6"
Slurry, Sand & Dredge

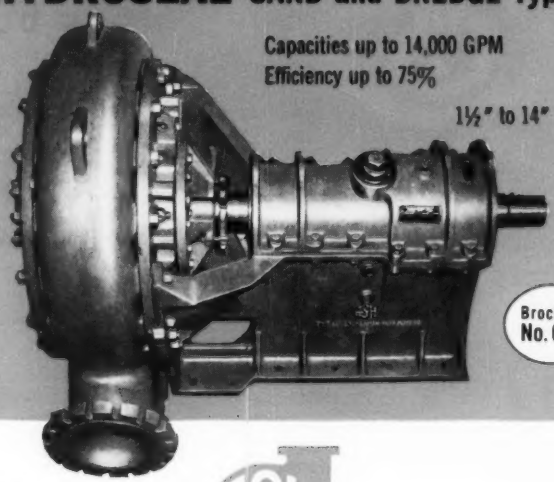
METAL PUMPS

Brochure No. 357

To have an easy key to the correct type and size of pump, write us for "Technical Data" Brochure No. 357. For information in the category of your need, use the specified number. In the refinements of application, our engineers can help you.

HYDROSEAL SAND and DREDGE Type

Capacities up to 14,000 GPM
Efficiency up to 75%
1½" to 14"



Brochure No. 657

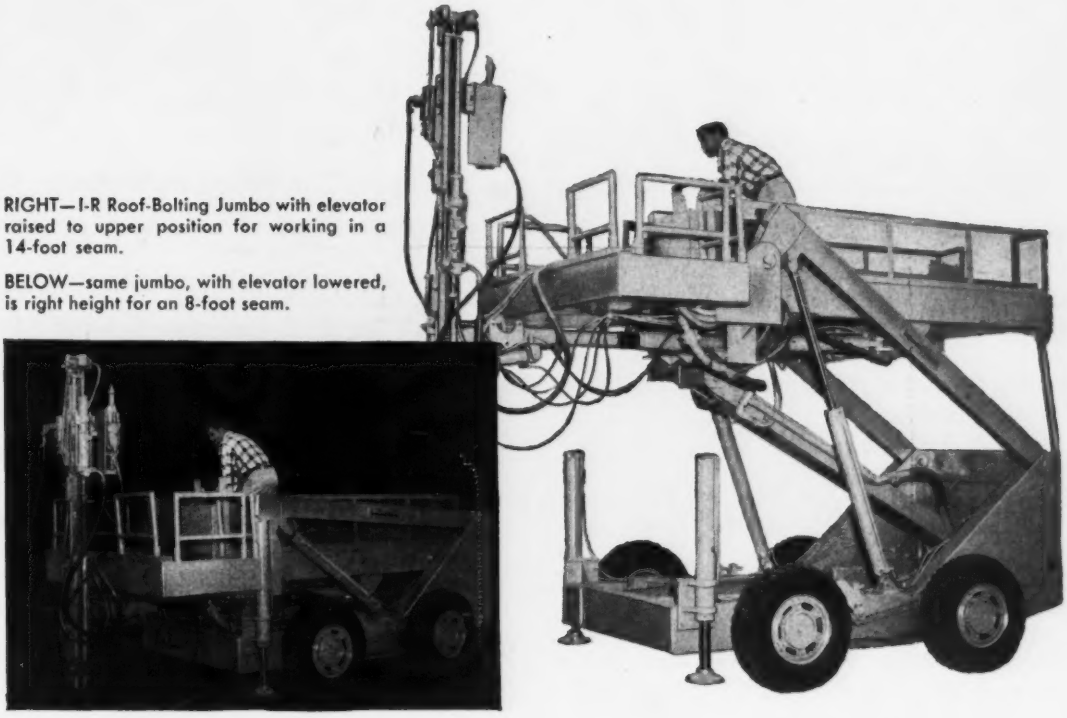
THE ALLEN-SHERMAN-HOFF PUMP CO.
Dept. B—P. O. Box 635, Paoli, Pa.
Representatives throughout the World

HYDROSEAL and CENTRISEAL
SAND, SLURRY & DREDGE PUMPS
MAXIMIX RUBBER PROTECTED

MECHANIZED ROOF-BOLTING

RIGHT—I-R Roof-Bolting Jumbo with elevator raised to upper position for working in a 14-foot seam.

BELOW—same jumbo, with elevator lowered, is right height for an 8-foot seam.



Special I-R ROOF BOLTING JUMBO drills, drives, and tightens bolts in 8 to 14-ft seams

Ingersoll-Rand rock drill engineers have come up with a unique solution to a troublesome roof-bolting problem on a job where with conventional stopers and temporary stagings, roof-bolting crews were hard pressed to keep ahead of drilling operations in a room-and-pillar mining system. Drillers often had to wait for roof bolts to be set before they could move in on a new face. Now a two-man crew easily keeps ahead of all drilling operations.

Each self-propelled jumbo consists of an elevator platform which carries a Hydra-Boom-mounted vertical drill feed with DB-30 drifter and Torque Control Impactool.

In operation, the jumbo is propelled into approximate drilling position by I-R air-motor drives—anchored with hydraulic leveling jacks—and the platform raised by hydraulic cylinders to the desired height. The drill is spotted in position by the Hydra-Boom and the hole is drilled. The drifter is then run down the feed, the steel removed and the Impactool swung into position above the drill. The roof bolt is inserted and drill feed raises the wrench into position for tightening the bolt to the required torque. All operations are throttle controlled from the upper deck.

If you have a drilling problem, Ingersoll-Rand's specialized experience can help you solve it—quickly and efficiently.

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ENGINEERING AND MINING JOURNAL

93rd YEAR OF PUBLICATION

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Your 1959 Guidebook

WHAT IT IS. This is the sixth annual *E&MJ* Mining Guidebook and Buying Directory. It is designed to work with the preceding issues in giving you the information you have indicated you need to better facilitate the job of planning exploration, mining, milling and smelting projects. The Guidebook presents equipment panoramas, charts and tables for present and future reference.

HOW TO USE IT. If you're planning a new project or revamping an old one, you can do better with the help of the six Guidebooks and Buying Directories which are indexed on pages 6 through 10. The index puts all the Guidebooks' information in a simple and accessible form. By using the Guidebook section in conjunction with the Buying Directory and the advertisements appearing in the issue, you can find out all you need to know before purchasing.

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Extra-tough hose for rugged jobs is also light, easy to handle

THAT hose carries air and water to a drill, breaking up chunks of ore in a lead mine. The hose is dragged across sharp, abrasive rock. It's twisted and bent. It's subjected to hot air from the compressor. Such abuse would shorten the life of most rubber hose. But not the B.F.Goodrich Commander air hose pictured here.

The cover of this B.F.Goodrich air hose is made with a tough, oilproof rubber. It stands rough treatment, has high resistance to scuffing, cutting, gouging, tearing. Special wire-braid reinforcement makes this hose stronger, tougher—helps it take higher pressures, provides a greater safety factor.

The lining of B.F.Goodrich Commander air hose is made with a special rubber compound that stands hot air, won't harden, crack, or break into gummy particles to clog tools. Strong and rugged as this air hose is, it is still light enough to be carried around without effort, extremely flexible so that it handles easily, doesn't tire workers.

Where to buy: Your B.F.Goodrich distributor has exact specifications on the B.F.Goodrich Commander air hose. And, as a factory-trained specialist in rubber products, he can answer your questions about *all* the rubber products B.F.Goodrich makes for the mining industry. *B.F.Goodrich Industrial Products Company, Department M-601, Akron 18, Ohio.*

B.F.Goodrich *air hose*

Behind the By-Lines...

Right now, friends, you have in your possession the biggest, most information-packed *E&MJ* in the 93-year history of the magazine.

As we wrote this, the total pages in the Mining Guidebook issue was nearing 440. You can check at your leisure to see if we've made it. In any event, it's 50-plus pages over the famous July 1953 issue on "Mining's Greatest Era."

While we've never held to the idea that bigness is an end in itself, you'll pardon us if we enthuse just a little. It can be a thrill just being a part of something like this, and a great strain on the humility.

We're pretty sure we can back up that phrase about being "information-packed," too.

Item: In the field of mining technology—fourteen pages, starting on p 208, of the latest in techniques and practices, with photographs and drawings to give you all the dope that will improve your own operation.

Item: In exploration—seven pages, jammed with material which was gathered under the working title of "exploration speedup" and which represents the most modern and efficient means now at your disposal in the endless search for new minerals. See p 201.

Item: In mineral processing—a complete description of the leach-precipitation-flotation plant at the new Hayden smelter of Kennecott Copper Corp.'s Ray Mines Division in Arizona. A flowsheet, pictures and full detail begins on p 104.

Item: In smelting—the Hayden smelter itself. Certainly one of the most up-to-date operations of its kind in the world, with the latest in materials handling, protective (and exact) electrical controls, and the obvious product of operations research and quality control, two of the strongest trends in modern mining. (p 96)

Item: Ten pages on refractory brick; the construction recommended for various jobs in the smelter, and the how, why and when of maintenance. You'll find complete illustrations to make the various points as quickly, simply and easily as we know how. See p 256.

Item: Sixteen pages, starting on p 222, representing the latest and best in mine plant design taken from the original drawings of the top firms in the field. Each design is from a working operation and is the product of years of thoughtful study and a creative approach to modern mine operation.

Item: A round-up of processing flowsheets, with the problems that each mill man faced and the result gained when the flowsheet took over the job. (p 238)

Item: The latest in instrumentation applications in a uranium mill, with a specialized flowsheet to show placement of the instrument and its function in the mill structure. (p 108)

Item: On mining people and what they're doing—two complete reports on association meetings, speakers and subjects discussed. The first on-the-scene report covers the Canadian Institute of Mining and Metallurgy (p 114), and the second (see This Month in Mining) covers the general meeting of the Wyoming Mining Association. The latter story is the second half of the Wyoming story—we were able to get the news which Jesse Johnson made at Riverton in last month's issue.

Item: "Power for the Mine"—an eight-page summary of the types and applications of various power sources in the mining industry in the U.S. and elsewhere (p 248) with charts and pictures.

Item: In the equipment field—an expanded New Products Digest section with the latest in modern equipment, plus a 47-page Buying Directory. The latter is a result of a mine machinery and services census which is the sixth of its kind and the end-result of annual improvements and additions. It begins on p 266, a page we hope you'll be turning to for many months to come.

Like we say, information-packed.

That competition we mentioned last month—the one run by the Copper and Brass Research Association for "an outstanding achievement in the use, application, or metallurgy of copper and its alloys"—was won by Joseph E. Seagram & Sons Inc. for its "trail-blazing use of bronze curtain walls on the unique Seagram Building in New York City—the world's first bronze skyscraper."

We've passed that imposing structure a number of times and have been impressed. But we must admit that we'd never thought of it as a likely contender in the copper and brass research sweepstakes. Oh well, it's to be expected. In years of taking raffle chances, we've never so much as won a tired turkey.

Incidentally, Seagram returned the $1,000 first prize money to CABRA for a scholarship aid to a mining school student. They kept the bronze plaque, though. Probably it goes with the general decor.

Our Mr. Huttl is spending a couple of months doing some looking around in Europe, for your future edification. His latest contribution (p 96) was prepared just before his departure for Spain, Italy and Germany and those nations' leading mines.

The following is taken from his latest missive, and represents a preview of a full length article, with on-the-spot photographs, which will be coming your way as soon as possible.

"The show piece of the trip so far was the open pit iron mine of Cia. Andaluza, near Guadix. Here, as at other properties, received a most friendly welcome. The mine is about 81 km from Granada, on the north flank of the Sierra Nevada. Ore occurs in limestone domes, covered by alluvium about 100 m thick. The domes proper rest on layers of shales and mica schist. Orebodies mined are mushroom shaped, and the domes contain flat beds of impervious clay. The hematite assaying about 54% Fe is the result of substitution of the Triassic limestone by mineralizing agents.

"The alluvium overburden requires no blasting. Two 1930 Bucyrus B-75 shovels with 2½-yd dippers load ore from the pit. . . . The company is very proud of the two shovels, which have handled more than 10-million tons of material and are still going strong. . . ."

There's a lot more, including some very interesting stuff on loading and an inclined skipway, but we're afraid you'll have to wait for John's article.

This represents a return for Our Mr. H. He worked in the Spanish mines at one time in his career and maintains a large friendship in that area to this date.

One observation sort of pleased us. . . . "The man in the street is still the same amiable, helpful, contradictory guy I met and associated with during my 2½-year sojourn in Spain 32 years ago."

SPECIAL REPORT TO CATERPILLAR OWNERS:

CAT CATERPILLAR

Parts you can trust
Dependable round-the-clock service

CUT MAINTENANCE COSTS...EXTEND EQUIPMENT LIFE

BY CHANGING OIL AND FILTERS AS RECOMMENDED

How often should lube oil and filters be changed? The answer is obvious—when the lube oil and filter can no longer do their jobs. But how do you know when that time comes? Can you afford to guess?

Guessing can be costly. The cost of oil changed *more frequently* than necessary adds up to big sums during a work season. *Delayed* oil changes can bring about premature overhauls with more parts replacement costs.

Manufacturer recommendations are based on sound principles. Rapid advancements have been made in perfecting "additive" lube oils that can reduce wear. The familiar ridge left in liners by the piston rings can be practically eliminated by the use of Series III Oils and proper maintenance practices! These oils also allow longer periods between changes.

Full benefit and savings from new oils cannot be had without proper filtering. Caterpillar Engines have an emergency by-pass valve that opens and allows unfiltered oil to circulate if the elements become clogged. And elements become clogged when their dirt-holding capacity is reached. Caterpillar elements have ample dirt-holding capacity to keep the by-pass *closed* over the recommended period.

But aren't the dirt-holding capacities of all makes of filters about the same? To protect the long life reputation of Cat Diesel Engines, Caterpillar continually tests all brands of elements offered for Cat Engines. Below are the *surprising* results, based on tests of filters purchased on the open market during 1957 and 1958. During these tests commercial test dust was gradually added to clean oil until each filter clogged and the emergency by-pass valve opened. The amount of dirt added is recorded in the "Sediment Index" column.

HOW CAT FILTERS COMPARE WITH OTHER BRANDS

Brand	Filtering Area (Square Inches)	Sediment Index (In Grams)	Comparison
CATERPILLAR	1450	75	Used as basis for recommended oil and element change periods.
BRAND A	1450	13	Cat element lasted nearly 6 times longer.
BRAND B	1170	22	Cat element lasted 3 times longer.
BRAND C	1000	34	Cat element lasted more than twice as long.
BRAND D	Not measurable	No oil flow	Opens by-pass immediately even when new.
BRAND E	1450	26	Cat element lasted nearly 3 times longer.

SERVICE TIP: Get your copy of "Crankcase Lubricating Oil Change Recommendations," Form 32421-1W, from your Caterpillar Dealer right away. Keep pace with the new lube oil developments.

Your Caterpillar Dealer has the complete story on the advantages of changing lube oil and filters as recommended. Ask him to figure your annual engine oil costs for you, and see how much you can save. See him today!

Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

CATERPILLAR

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Index to Your Guidebook Library

E&MJ's ANNUAL MINING GUIDEBOOKS are designed to complement and supplement each other. This index will help you find subjects covered in the six issues that have been published so far — May 1954, Mid-March 1955, Mid-June 1956, 1957, and 1958 and this, June 1959.

This cumulative index has been extracted from our indices which are published annually in December. The Annual Index also includes subject cross references to help the user find subjects more readily but these have been omitted from this Guidebook Index. Commodity, country, company and author references, a normal part of our Annual Index, have also been omitted.

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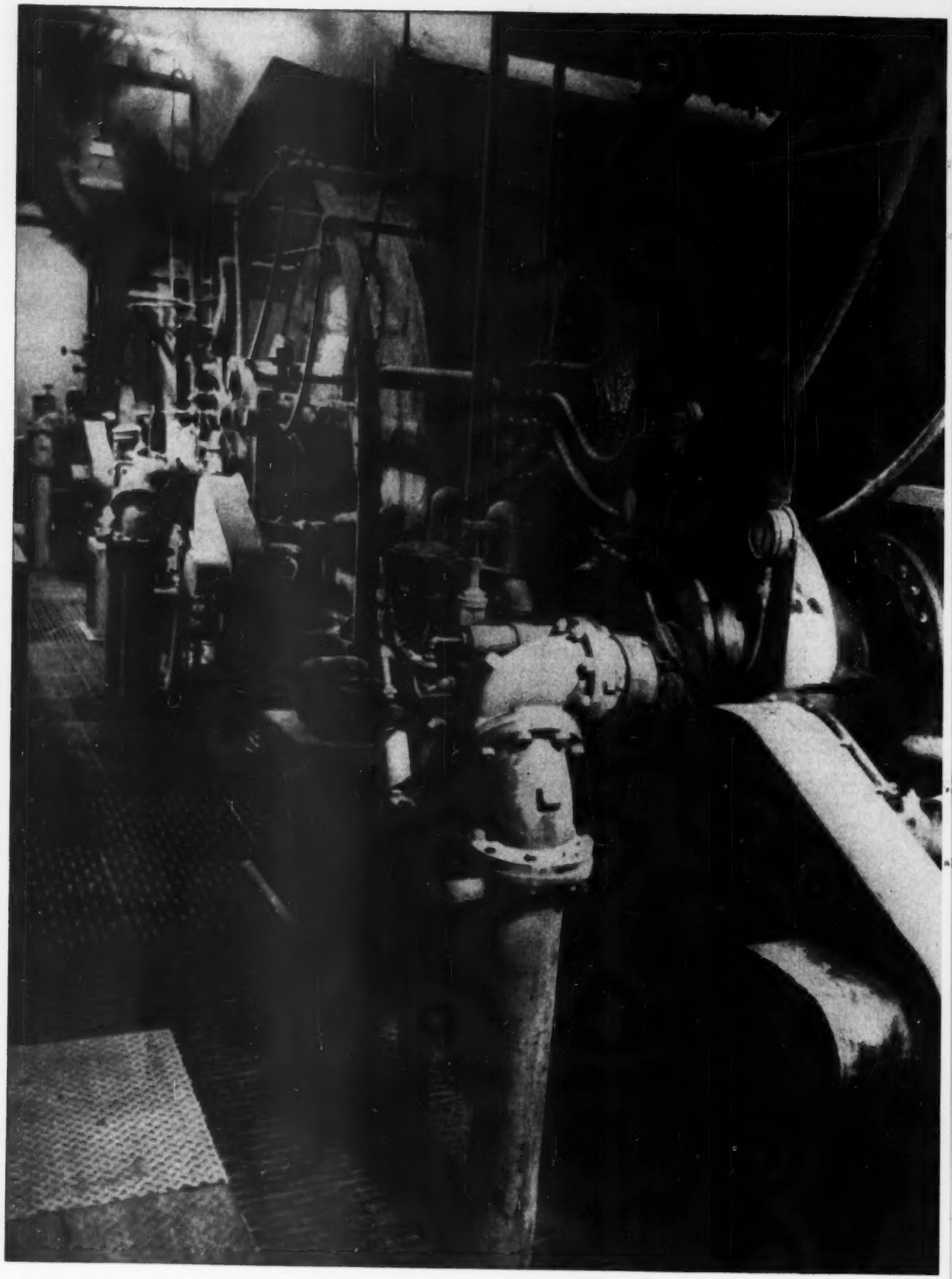

SUCCESS STORY AT ANACONDA'S GRANTS, NEW MEXICO, URANIUM MILL

tonnage up, maintenance down, using OLIVER DRUM FILTERS with new snap in-out rubber grids

Ore from the famous Jackpile ore body is processed at Anaconda's Grants, New Mexico, carbonate leach uranium mill. In the 1954 expansion program, three Oliver Continuous Rotary Drum-Type Filters were substituted for batch filtration equipment previously used. Easily removable snap in-out support grids, an exclusive Dorr-Oliver feature, were originally of wire, but have since been replaced by the Company's recently developed rubber waffle-type.

The Oliver filters have been in continuous operation since Spring, 1955, with no shut-downs except for cover changes. Since installation of the rubber grids, tonnage handled has been nearly doubled from 300 to 600 tons per day. Cloth life averages 60 days. The combination of high production and exceptionally low maintenance expense has resulted in substantial cost reductions per ton of ore treated.

Filtration is carried out in three stages, with repulping between stages. Additional Dorr-Oliver equipment includes O.D.S. Diaphragm Type Pumps on Filtrate and Slurry Service. Slurry handled contains 50% solids. There are also acid-proof Dorr FH Classifiers and DorrClones on acid leaching service and Dorr Agitators on autoclave discharge. A noteworthy feature is the use of Dow "Seperan" to improve filtration. As a result, loss of water solubles has been reduced to a very low level.

The know-how of Dorr-Oliver engineers is based on over 50 years of world-wide experience in handling every type of filtration problem. For more information on Dorr-Oliver equipment or for assistance on your particular problems, write to Dorr-Oliver Incorporated, Stamford, Connecticut.

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Photo shows installation of 3 Oliver Drum Filters at Anaconda Copper Mining Company's uranium mill, Grants, New Mexico. Filters are 11'6" diameter x 18' face, with snap in-out waffle type rubber grids. Each filter handles about 600 TPD of ore.

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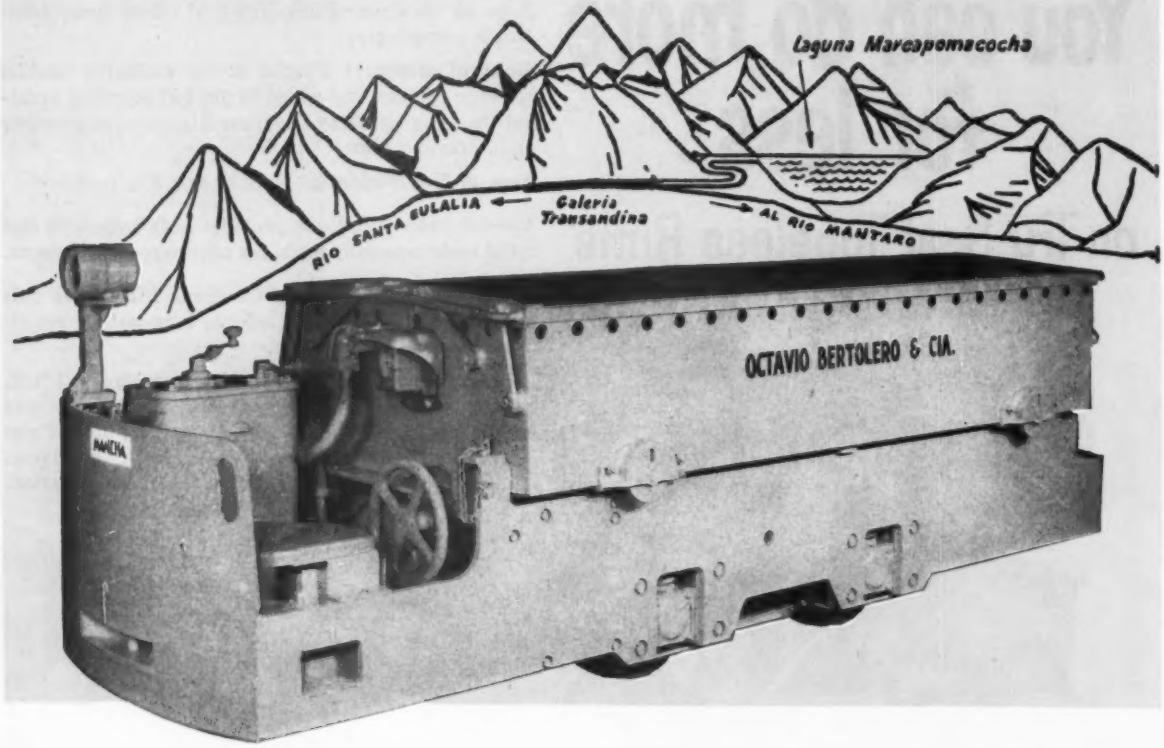

MANCHA STORAGE BATTERY LOCOMOTIVES

High in the rugged Andes Mountains, Mancha Storage Battery Locomotives are helping to drive a tunnel that will eventually result in additional electric power for Lima's booming metropolitan area.

A project of the Lima Light and Power Company and Energia Hidro-electrica Andina SA, the tunnel will tap water from the Atlantic watershed—release it down the western slope of the Andes into the Santa Eulalia and Rimac Rivers . . . feeding a series of hydro-electric plants as it flows to the Pacific. This increased water flow will allow expansion of existing installations . . . provide more power.

The tunnel is being driven at an elevation of 14,200 feet. Each of two headings will be 17,400 feet in length. In considering locomotives for the job, careful attention was given to motor capacity and the high running speed essential to maintain loading efficiency at headings. The contractor settled on the plus-safety factor, the power and speed of the Mancha Standard ANX Locomotive.

SPECIFICATIONS

Operating Weight.....6 tons
Total Horsepower.....54
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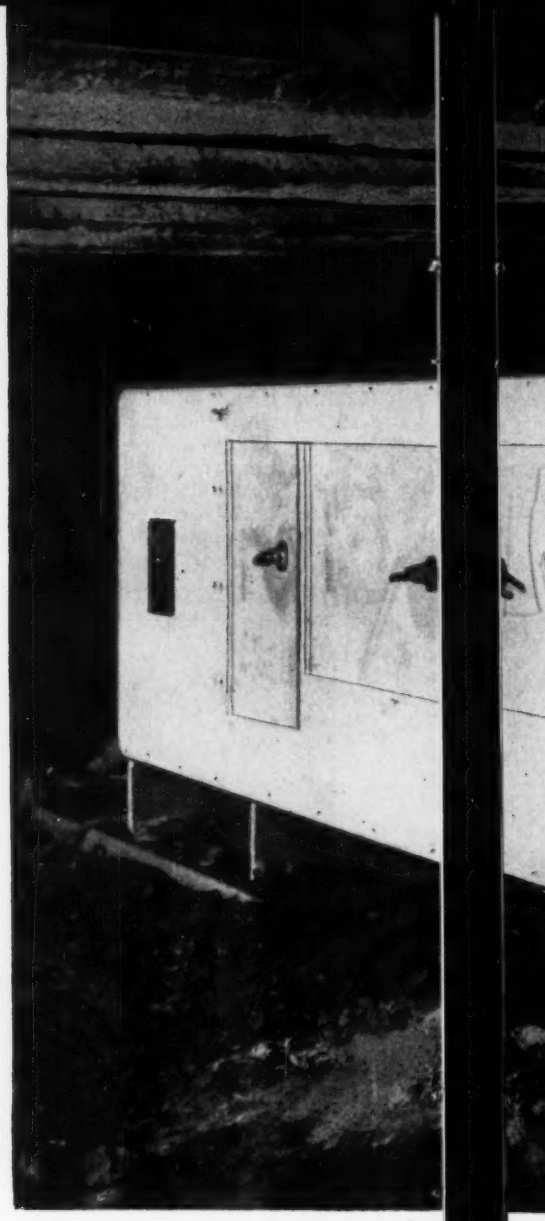
ONLY WESTINGHOUSE CONSTRUCTION SUITABLE FOR WORLD'S LARGEST SEALED DRY-TYPE MINE POWER CENTER



MINE power center specifications are extremely exacting . . . so exacting that only Westinghouse, the leader in the field, offered a construction found suitable for the world's largest sealed, portable mine power center.

Only Westinghouse construction could combine—in a unit with the desired 600-kva, 7200/480-volt rating—the necessary ruggedness, compact low height and light weight essential to easy portability within mine tunnels.

Here are the key features in this construction:

External ruggedness—A ¼-in. steel plate case protects against roof falls, rough use. A ⅜-in. base plate with ½-in. reinforcing skid runners protects the unit when skidded over rough bottom, haulage tracks, etc., during frequent relocation.

Internal ruggedness—Core and coils braced at both top and bottom to withstand full short circuit conditions, securely mounted in case to withstand moving and rough handling.

Low height—The most compact mine power centers made, the 600-kva unit is only 42 inches high, the 300-kva unit only 36 inches.

Low maintenance cost—Nitrogen-filled, sealed, dry-type power center is practically maintenance-free; protected against moisture even when de-energized during prolonged shutdowns.

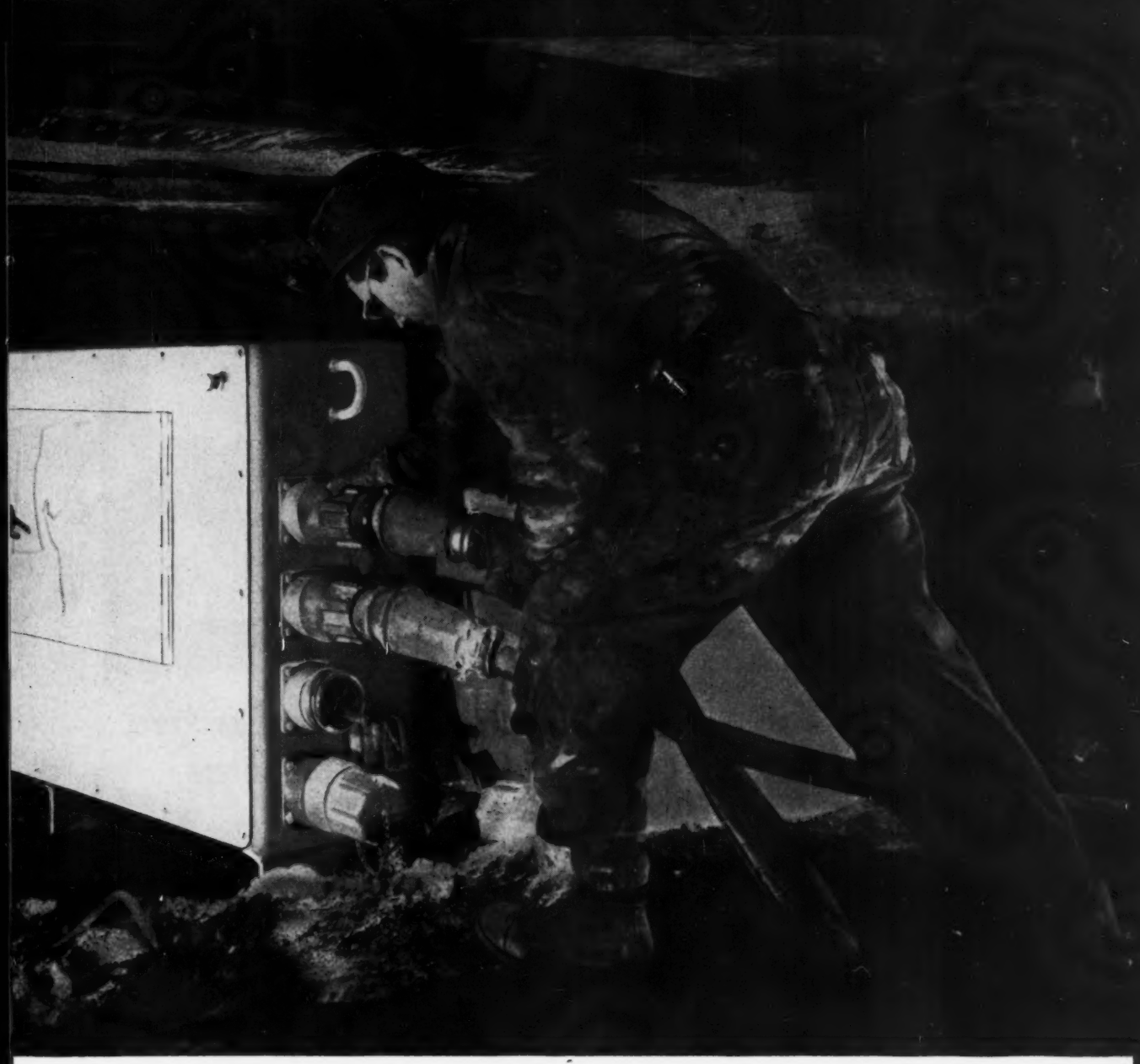
This sealed mine power center is but one of the complete line of Westinghouse power centers available to serve the mining industry above the surface, as well as below. Ask your Westinghouse representative about the power center to serve your specific applications.

J-70899

YOU CAN BE SURE...IF IT'S

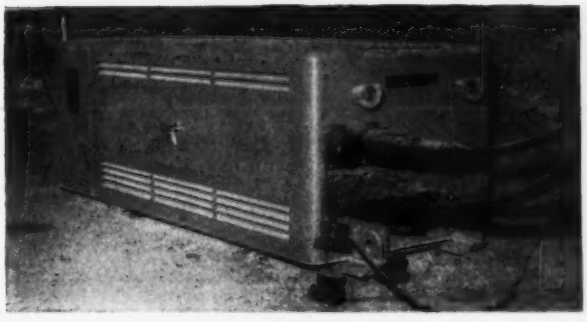
Westinghouse

WATCH "WESTINGHOUSE LUCILLE BALL-DESI ARNAZ SHOWS" CBS TV MONDAYS

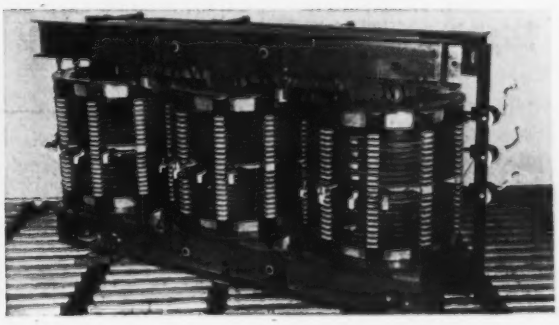


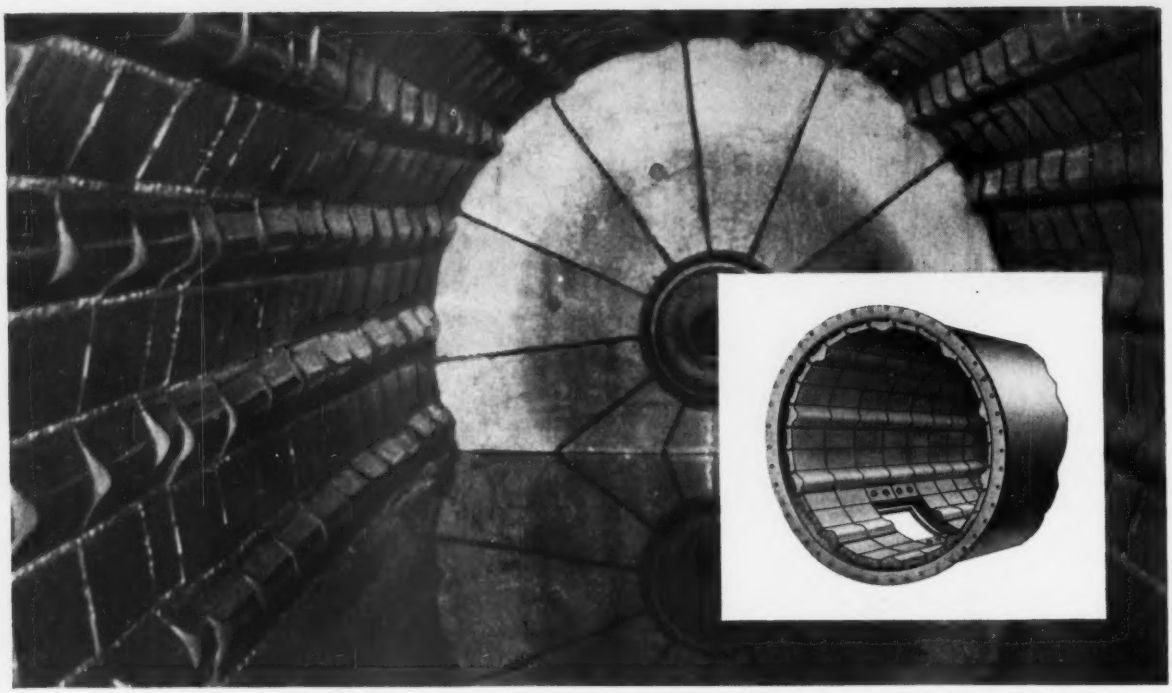
Convenient location of the high-voltage receptacle on world's largest sealed mine power center permits hitching to low-voltage end when unit is skidded to a new location. This allows unit to remain energized; high-voltage cable can pull straight without bending, and buggy can obtain its motive power from one of the secondary feeders.

A full range of ratings in ventilated mine power centers is available from Westinghouse for application where conditions are less severe—such as less dust, lower humidity.



Core and coil assembly for 600-kva, 7200/480-volt, 3-phase unit—world's largest sealed mine power center made by Westinghouse.





8 Reasons Why You Should Standardize with B&W Universal Liner Plates

Better Performance with Lower Costs—Same Casting Fits All Mill Sizes

B&W Tube Mill Liners reduce capital, time and labor costs. Consequently, they reduce the cost of the material ground. Here are eight reasons why:

1. Lower Initial Costs—standardization eliminates chiller and pattern costs.
2. Longer Life For Liners—better quality control on a mass production casting, utilizing permanent molds, results in uniform wear. Ideal size for uniform chill and heat-treatment.
3. Longer Life for Different Applications—this is assured by selection of proper materials. Design is suitable for either chilled irons or wear steels.
4. Reduced Costs in Both Direct Labor and Outage—installation time is less because small size and weight of castings allows them to be handled easily, without cranes and with less fatigue for workers.
5. Reduces Costs in Storage Space—because small castings stack easily, little storage space is required. One design of casting interchangeable for all size mills also simplifies records.
6. Reduced Costs in Liner Inventory—standardization is possible because one design fits all diameters of mills. Standardization means quicker unloading and storage.
7. Reduced Costs on Breakage Claims and Delays for Replacements—small castings are rugged and almost impossible to break by handling. Large castings of hard, brittle irons sometimes break in shipment.
8. Reduced Costs in Determining Most Efficient Wear Patterns—you can get wear profiles consisting of all lifter ribs or all flats from the same castings, as well as a combination of both including straight or spiralled lifter pattern.

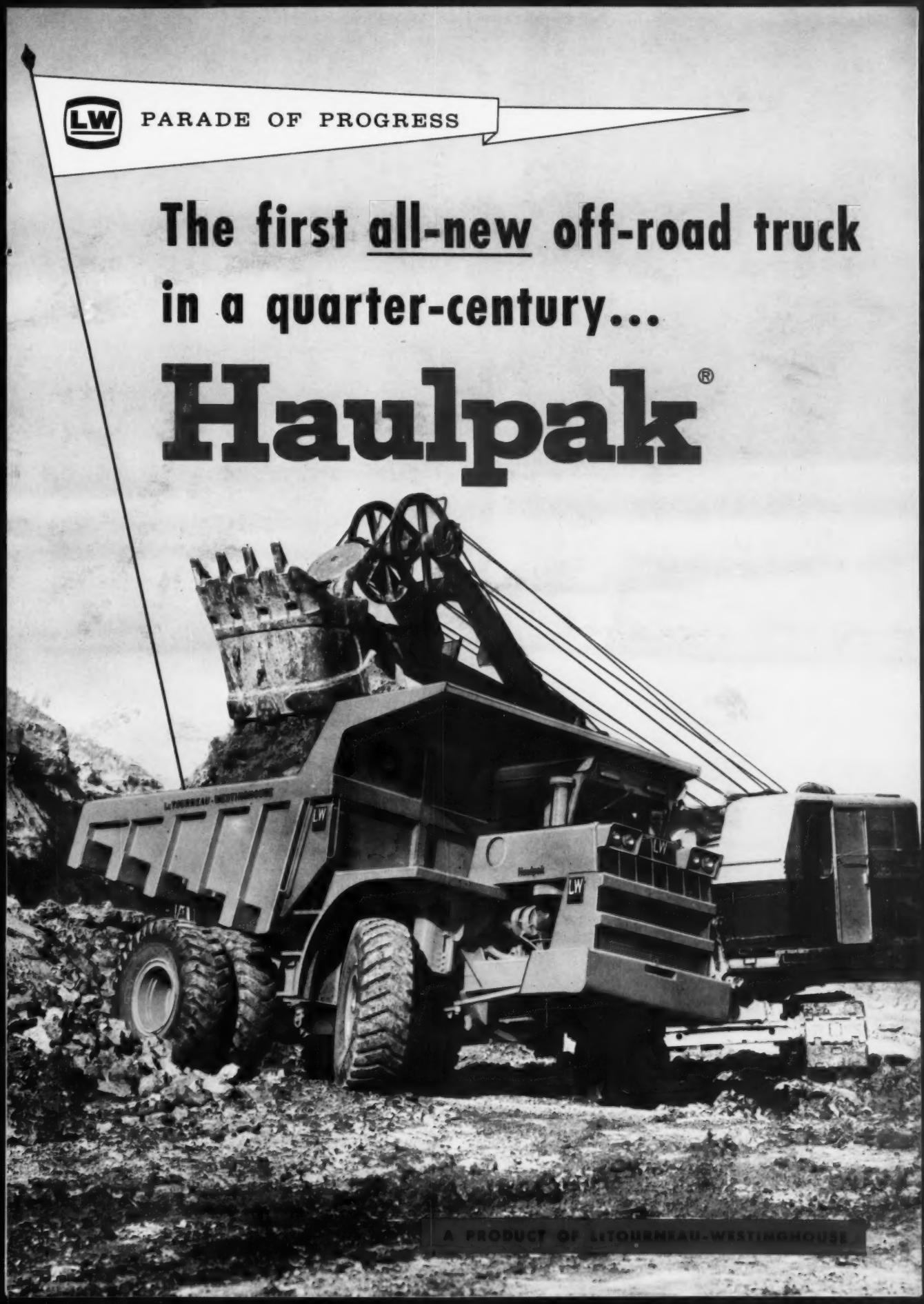
Liners are supplied in two nominal thicknesses, 1½″ and 3″ with 1½″ high lifters. Castings are 6″ wide x 12″ long. Positive seating of small castings on mill shell means less breakage of castings under operating conditions. For additional information on B&W Universal Tube Mill Liner Plates write The Babcock & Wilcox Company, Boiler Division, Barberton, Ohio.

B&W

THE BABCOCK & WILCOX COMPANY

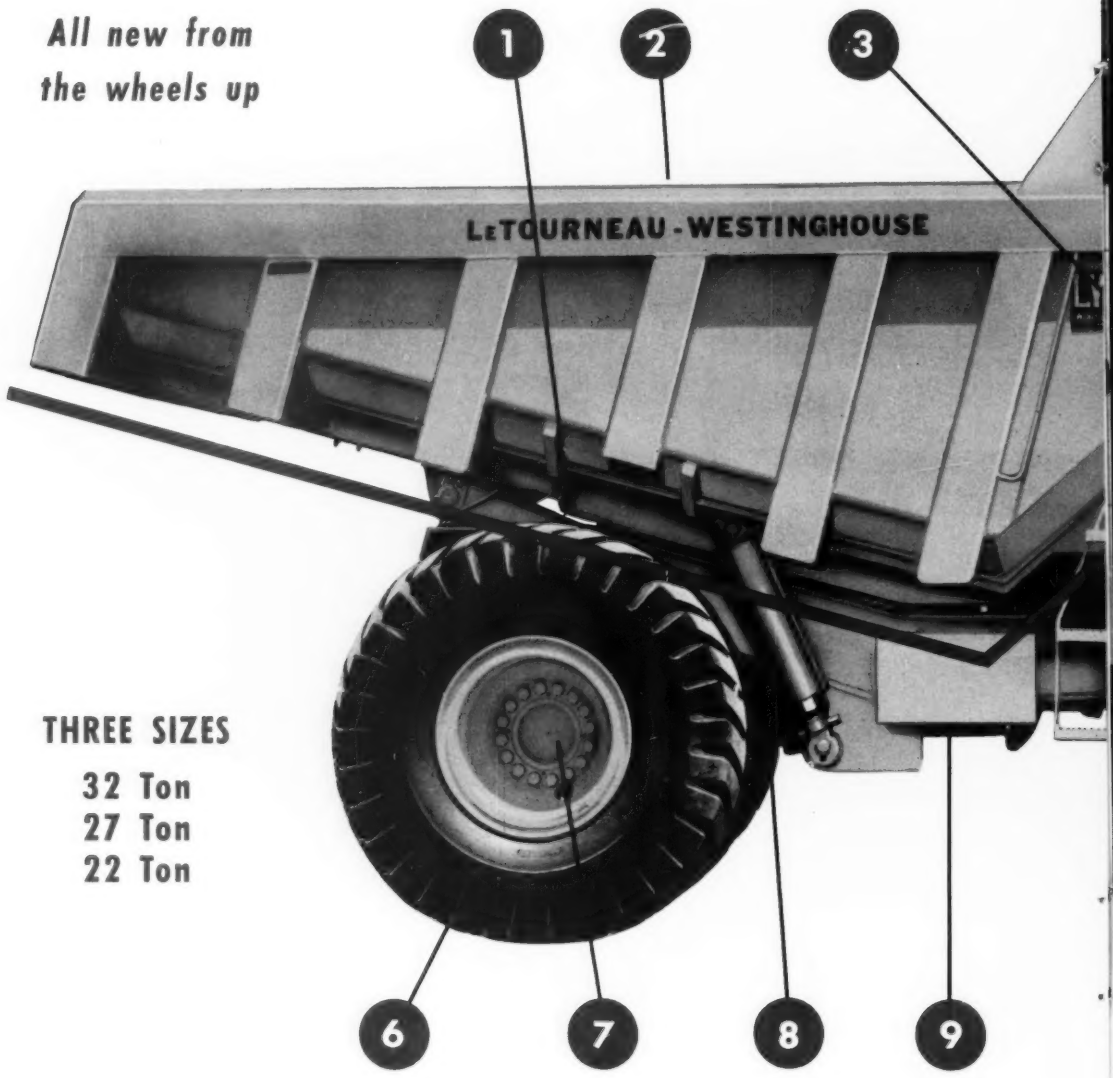
BOILER DIVISION

8-471


LW
PARADE OF PROGRESS
The first all-new off-road truck
in a quarter-century...
Haulpak®
A PRODUCT OF LeTOURNEAU-WESTINGHOUSE

Haul more tons per man-hour with

All new from the wheels up



THREE SIZES

32 Ton
27 Ton
22 Ton

Look at these important advanced HAULPAK features...

1. **"V"-shaped body** — gives you bonus yardage within a short wheelbase. Furthermore, with the LW wedge-shaped body, loaded material quickly fills all corners for big low-void payloads. It also provides a low center of gravity . . . gives Haulpak the stability needed for high-speed hauling over rough roads and steep grades.

2. **Low loading height** — (only 10'1" on the 32-ton size) and large top opening (14'5" x 11') makes it easy for shovel operators to load Haulpak fast, without spillage.

3. **Big, roomy cab** — with canted windshield has many work-efficiency features.

4. **Strong, protective canopy** — covers cab completely.

5. **Positive power steer** — and sure-grip, auto-size steering wheel — for safe, easy handling. Steering system is located high behind bumper, protected from damage.

6. **Six big 18.00-25 tires** — for better traction and smooth, cushioned ride.

7. **Exclusive power-transfer differential** — automatically transfers power to wheel on firmest footing for maximum traction. This same, patented LW differential has boosted production and profits for thousands of LW Tournapull® owners for more than 14 years . . . and now, *for the first time*, it is available on a truck.

8. **Fewer moving parts** — between engine and wheels saves power and reduces maintenance costs. Haulpak's final drive has only six gears, compared to the twelve or more found in the normal big trucks.

9. **100% rubber-mounted body** — cushions loading shocks. Engine, transmission, radiator, and cab also rubber-mounted to minimize vibration.

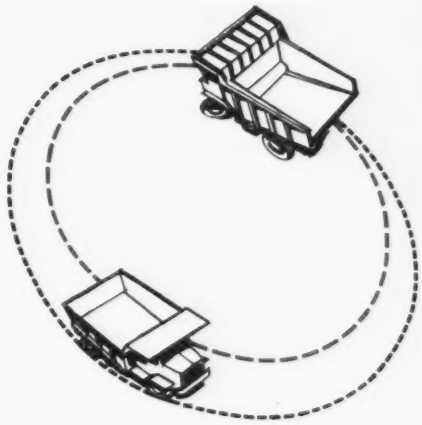
10. **Four separate braking systems** — for fast, safe, sure stops. System includes Torqmatic brake in the Haulpak transmission and big, disc-type air brakes on all wheels having four times the braking surface of conventional trucks.

11. **"Power-Miser" fan** — standard on all Haulpaks, requires only 10 hp to operate, compared with the 30 to 35 hp needed for conventional fans. Thermostatically controlled, fan shuts off *automatically* when engine heat falls below efficient operating temperature . . . permits engine to maintain correct temperature, releases more horsepower for tractive effort.

LW Haulpak

Hauls up to 30% more payload than its weight

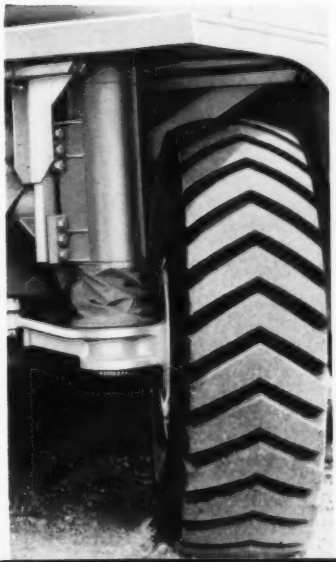
With Haulpak, more horsepower is used to haul the payload, little is wasted hauling useless truck-weight. Although light in weight, Haulpak is built exceptionally strong. Its body and box-beam frame are constructed of high-tensile-strength steel ... nearly 3 times stronger than steel commonly used in trucks, yet it weighs ⅓ less. Frame structural members also serve as air reservoirs for the operation of air brakes ... to further eliminate non-profitable dead-weight.



Turns in less space than the average pick-up — with a wheelbase of only 130", Haulpak makes complete 180° turn in area only 44½' wide — far less than units of similar capacity. This unusual maneuverability permits Haulpak to spot, swing around, back up, and dump without lost motion to delay hauling cycles.

Dumps in seconds — Twin 3-stage hoists lift body in seconds to a *high 70° angle* for fast, complete ejection of load. Body is exhaust-heated to prevent materials from freezing and sticking. There's no "carry-back" problem with Haulpak.

Needs NO daily maintenance — Haulpak's bearings *never* need lubrication ... they're moly-coated to resist abrasion, packed in grease, and sealed for life. The entire Haulpak lubrication check — *needed only at 500-hour intervals* — consists of just 3 easily-reached grease fittings. What's more, you can operate a big Haulpak fleet on a *minimum parts inventory* ... because final drives, Hydrair cylinders, wheels, and tires are interchangeable. Haulpaks work longer, harder, with less downtime ... give you more output per man-hour.



Has no springs ... rides on Hydrair*

Haulpak's exclusive air-hydraulic suspension system completely eliminates maintenance and repair of springs. 4 Hydrair units cushion against loading and travel shock. System compensates *automatically* for off-center loading and keeps unit riding level over humps and holes. Other Hydrair benefits to you: less dead-weight, higher ground-clearance. Hydrair cylinders fit close to wheels, up out of dirt and moisture.

*Trademark

Already a fully-tested hauler

This all-new LW Haulpak is the result of more than 3 years of research and development by LeTourneau-Westinghouse engineers — pioneers of a long list of earthmoving and hauling equipment. All three Haulpak models have been put through rugged tests under the toughest working conditions for over 14 months — in mines, quarries, and on construction jobs. Its various parts and assemblies — some of them tested and proved by *millions of hours* on LW Tournapulls all over the world — are much stronger than those on ordinary haulers. With the new LW truck you can be confident your truck maintenance, repair, and operating costs will drop to a new low . . . and your hauling tonnage will climb to new highs!

Your nearby LeTourneau-Westinghouse Distributor can give you full details on the new LW Haulpak. And, as a specialist in the earthmoving and hauling field, he can help solve any other equipment or service problems you may have. His shop is well-equipped . . . parts stock is complete . . . and his factory-trained staff is ready to provide you with the best possible service, day or nite. Call on him soon!

Note easy-loading features of Model 27 Haulpak as it gets heaping load of overburden in this quarry.

Here, 38.8-mph Model 32 Haulpak "highballs" a big load of overburden at iron mine.

Another load of rock moved in a hurry! This Haulpak works for an eastern contractor.

PARADE OF PROGRESS

continues

The new Haulpak truck is the latest addition to an impressive array of new and improved earthmoving and hauling machines being unveiled by LeTourneau-Westinghouse Company. They're part of LW's continuing program of product development to give you highest production equipment at lowest ownership-operating cost.

CONDENSED SPECIFICATIONS

HAULPAK MODEL:	LW 22	LW 27	LW 32
Capacity			
Tons	22	27	32
Heaped, cu yd	24	27	30
Struck, cu yd	15	18	21
Power	320-hp 6-cyl. Cummins diesel	335-hp 6-cyl. Turbocharged Cummins diesel	375-hp 6-cyl. Turbocharged Cummins diesel
Speeds	Step-gear trans. Five forward speeds to 37.4 mph, two reverse to 3.6 mph	Power-shift trans. Four forward speeds to 35.4 mph, two reverse to 6.9 mph	Power-shift trans. Four forward speeds to 38.8 mph, two reverse to 7.5 mph
Dimensions			
Length	23'10"	23'10"	23'10"
Width	12'0"	12'0"	12'0"
Height	11'5"	11'5"	11'5"
Wheelbase	10'10"	10'10"	10'10"
Weight (lb)	40,820	43,020	44,950

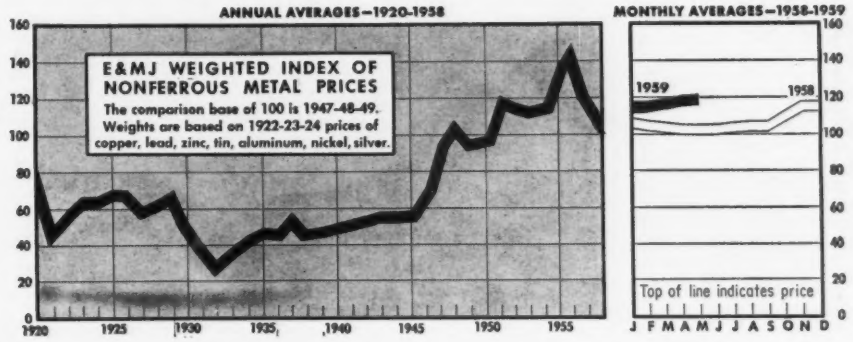
(Specifications subject to change without notice)

Litho in U.S.A. HP-2100-G-4

Where quality is a habit

LETOURNEAU-WESTINGHOUSE COMPANY
PEORIA, ILLINOIS
A Subsidiary of Westinghouse Air Brake Company

E&MJ OUTLOOK



MARKETS

Higher prices for lead and zinc moved E&MJ's nonferrous metals price index upwards from 120.1 for April to 120.9 for May. Copper was down slightly.

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AT HOME

Fluor Corp. has been working under a grant from the U.S. Department of Interior to convert salt water to fresh water with a nuclear reactor. Preliminary costs and designs have been submitted. A final report will be completed within two months.

The United States must ultimately shift to the metric system to keep up with the increasing volume of calculations required by society, according to Lewis L. Strauss, Secretary of Commerce.

Commercial shipments of aluminum during the first half of 1959 should total about 1,150,000 tons according to R. S. Reynolds, Jr., president of Reynolds Metals Co. Total for the year is expected to be about 1.9-million tons, 20% greater than in 1958.

U.S. Bureau of Mines has successfully converted 387,000 lb of powdered nickel oxide into metal in an experimental direct-reduction process developed at Bruceton, Pa.

J. R. Simplot Co. plans to build a $2-million clay and silica refining plant at Bovill, Idaho. Production is expected to total 100,000 tons of clay and 100,000 tons of silica annually.

Kennecott Copper Corp. has shipped 50 cu cm of "copper eating" bacteria to the Instituta Metalurgia of the Universidad de Chile for experimental purposes. The culture has been used to contribute to leaching of copper from waste dumps at Bingham Canyon.

LABOR

Mine Mill and Smelter Workers Union is asking for an escalator clause tied to the cost of living. United Steel Workers and Railroad Workers have had such clauses during recent years, but neither wants to renew them this year. See p 25.

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ABROAD

Broken Hill South, Ltd. has acquired or applied for prospecting rights to explore several favorable mineral properties indicated by aerial geophysical surveys in the Broken Hill district.

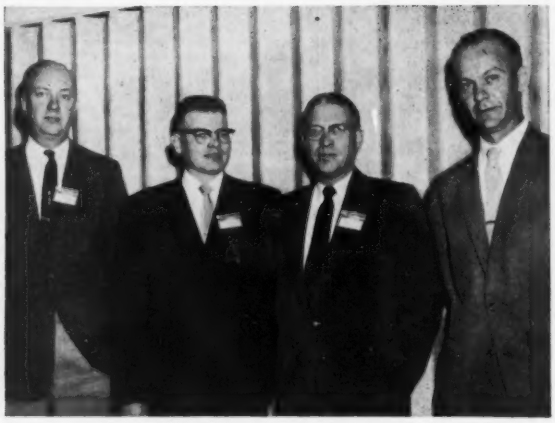
Mexico's Atomic Energy Commission is reported to have stockpiled some 3,000 tons of high-grade uranium ore in the State of Chihuahua. Two plants will be installed this year to treat the ore. Commission teams have located 22 areas containing sufficient uranium ore to warrant mining.

Rio Tinto Dow, Ltd. has completed a $1-million solvent extraction plant at Elliot Lake to recover thorium from waste liquors produced in the Blind River uranium mills.

Two German metallurgists representing the West German Government are studying the feasibility of installing lead and zinc refineries in Peru.

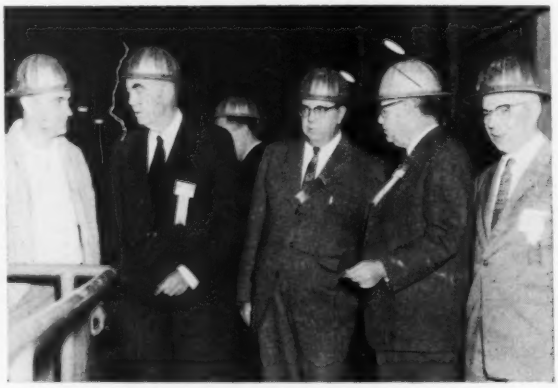
THIS MONTH IN MINING

TECHNICAL PAPERS on open pit mining, sampling, blending and drilling were presented by a panel led by A. W. Runge, of Susquehanna Western, and including (l to r): Galen Quigley, ore control engineer, Vitro Minerals Corp.; John Atkins, mining engineer, Utah Mining Co.; Don Anderson, chief geologist, Lucky Mc Uranium Corp.; and A. L. Slaughter, chief geologist for the Hauber mine, near Devils Tower, of Homestake Mining Co.



TRONA AND CEMENT were the subjects of papers also presented at the meeting, by James F. Van Denburg and Joseph F. Bailey, (second and fourth from left). John L. Chapman, of Chapman and Moorhouse (left) and H. E. Potter, superintendent of Monolith Portland Midwest Co. (third) also participated. Van Denburg is a chemical engineer, Intermountain Chemical Co. and Bailey, field engineer with Portland Cement Assn.

NEIL MC NEICE, prospector and Riverton machine shop operator, received the Association's "Bronc Buster" award from Governor J. J. Hickey. Jesse Johnson is seated. McNeice made the original discovery in the Gas Hills in September 1953.



ON THE FIELD TRIP to the Susquehanna-Western mill, superintendent Jerry Bryant explained the fine points of the process to Jesse Johnson, Governor Hickey, Lou Hazen, designer of the mill, and A. W. Runge, ore procurement, S-W.

Wyoming Mining Assn. Studies Area Technology

The following is a report of the annual meeting of the Wyoming Mining Association, held at Riverton in mid-April. The initial part, which appeared on p 22 of the May issue, covered the remarks of Jesse C. Johnson, director of the AEC raw materials division on uranium contracts.

R. J. STOEHR, superintendent of mines for Homestake-New Mexico Partners, Grants, N.M., told the association that present milling rates of 11,000 tons will run for some time in excess of mining rate. The current mining rate is 8,600 tpd, he said.

"The immediate problem which the area faces is a shortage of ores for some mills," he declared.

Seriousness of the problem is emphasized by fact that "to bring the mines and mills of Ambrosia into production approximately $90-million has been invested", he said. "At present time, some 3,000 men are directly employed in area mining and milling activities.

"However, the fact remains that some of the mills that have been constructed have operated and will operate for substantial periods of time at considerably reduced tonnages" and consequent lowering of profit margins.

Mr. Stoehr said that the "second immediate problem which the area faces is one of mining costs." He said that "this problem will be with the district for a considerable length of time and as yet very little is known about the ultimate costs of mining the ore below the water table."

But he said that is was apparent to date that the cost generally would be "quite high" compared with mining in Wyoming or some other states.

Costs are now running from a low of $4.50 a ton in dry, shallow mines, to a high of possibly $12 to $14 a ton in wet, deeper mines. While such costs in-

clude direct and overhead expenses, they do not include average of $2 a ton royalty and between $1.50 and $2 write-off costs for capital equipment items, etc.

"By using these rough costs and applying a 5% per year inflation increase, it would seem that the Ambrosia Lake district could produce 0.20% U_3O_8 ores at a slight margin of profit in the 62-66 period," he said.

"There will have to be a great many favorable improvements and developments in the area to make the district, in general, one that will be competitive in any free market which may develop after 1966.

"However, there definitely will be certain operations in the Ambrosia Lake area that will be extremely competitive on a world-wide market after 1966 and possibly prior to 1966," he said.

Some idea of the water problem in the deeper mines was given by Mr. Stoehr. "At one of our mines," he said, "we have produced approximately 50,000 tons of ore and produced, at the same time, approximately 1,250,000 tons of water."

Other speakers included J. F. Van Denburg, technical service engineer, Intermountain Chemical Co., Green River, Wyo., who painted a picture of expanded use in western industry of soda ash produced from trona deposits in southwestern Wyoming.

Mr. Van Denburg said that chemical use of high purity soda ash—including the role of the mineral in beneficiation of uranium, bauxite and alumina ores and in iron ore up-grading—was fast over-taking the employment of ash in the glass industry.

Intermountain, a subsidiary of Food Machinery and Chemical Corp. and National Distillers Products Corp., has been in almost constant expansion since commencement of operations near Green River in 1948. The firm reportedly now accounts for nearly 40% of U.S. soda ash.

(*Continued on p318*)

Mining Calendar

Air Pollution Control Association annual meeting, Hotel Statler, Los Angeles, Calif. June 22-26.

Idaho Mining Association annual meeting, Sun Valley, Idaho, July 5-7.

Institution of Mining Engineers Symposium on Shaft Sinking and Tunnelling, Olympia, London, July 15-17.

1959 Convention, American Mining Congress, Denver, Colo. Sept. 14-17.

Ninth Annual Exploration Drilling Symposium, Pennsylvania State University, University Park, Pa. Oct. 8-10.

Eighth National Clay Conference, University of Oklahoma, Norman, Okla., Oct. 12-14.

Annual meeting, AIME, New York, Feb. 14-18, 1960.

Australasian Institute of Mining & Metallurgy, Adelaide Branch, Symposium on Hydrometallurgy, "Wet Processing of Minerals and Industrial Products," Feb. 16-19.

As We Went to Press . . .

The AEC has announced that additional time will be given to uranium miners for filing applications for certification and bonus payments in Grand Junction. Certification must be made before April 18, 1960 and applications for bonus payments for production from certified claims must be made on or before May 31, 1960 or within 45 days after certification, whichever is later. Initial production for both applications must be delivered to the mill or buying station on or before March 31 of next year. The Commission also has requested that miners who want to be considered in 1962-1966 concentrate procurement negotiations submit ore reserve data to the AEC before Aug. 1, 1959.

AEC's Monticello, Utah mill will close Jan. 1, 1960. The mill needed at least 300 tpd to operate economically and has been receiving only 100 tpd. "Adequate markets are available at other privately operated mills in the same general area," says AEC.

A contract between Globe Mining Co., a Union Carbide subsidiary and the AEC has been signed for a $3-million, 492 tpd uranium mill in Wyoming's Gas Hills. Only one contract of the previously announced plan to add 1,700 tpd new mill capacity in Wyoming is still pending; with Susquehanna Western Corp. at Riverton.

Liberia's Mount Nimba iron ore deposit (see E&MJ, p 152, March 1958) may soon be under development by the Liberian-American-Swedish Mineral Co. and Bethlehem Steel. The plan envisages an open-pit 170 miles from the coast with a railroad and harbor.

India is adding to its mineral expansion program. One project, just starting, will develop lead, zinc and silver deposits in Udaipur and construct a new $12.6-million zinc smelter for Metal Corp. of India. The project will be financed, in part, by Rio Tinto. The second, a 2-million ton expansion of India's largest private steel company, Tata Iron & Steel Co., has been completed. The Tata project was assisted by Kaiser Engineers Overseas Corp.

A 200-tpm zinc metal plant (99% pure) near Mexico City was announced last month. The plant will be a 50-50 venture of American Smelting & Refining Co. and Productos de Cinc y Plombo, S.A., a Mexican company. Estimated cost is $450,000.

Another group, Tamsa, announced that before the end of 1959 it will start building an aluminum plant with French or U.S. backing.

A bill to lock up the Defense Production Act inventory, make it unsellable without express Congressional approval, was introduced in the Senate by Sen. James Murray and the Senate Interior group. By agreement it was not to be brought up for any action until this month. The bill is seen as a counter move to the proposed Material Reserve Inventory (see p 22).

WASHINGTON IMPACT

Highlights

STOCKPILE DISPOSAL PUSHED—A showdown on Government stockpile disposal policy is near. The issue of what—if anything—the Administration should do with strategic commodities it considers in excess of emergency needs has been heating up since 129,000 tons of copper in General Services Administration's defense production act inventory was tentatively earmarked for disposal two months ago.

That move was squelched by a combination of violent international market reactions and the quick opposition of mining-state Senators. But a number of new developments (see story this page) subsequently came to light. They show how serious the Administration is about ridding itself of unwanted surplusses.

LEAD-ZINC OUTLOOK HAZY—Metal-mineral policy officials in Washington are as vague on the market outlook for lead and zinc as ever—if not more so—in the aftermath of the third United Nations conference on the two key metals in New York last month (see story this page).

Washington is sitting tight. Interior Secretary Fred Seaton repeated again recently that no change is planned in present import quotas on lead and zinc. This means, for the time being at least, that neither political pressures for tighter or looser trade curbs will get anywhere. But they are still real factors in future Washington lead-zinc policy.

Washington reaction to the UN meeting reflects much confusion. Many experts feel the special committee was entirely too optimistic over its projected supply-demand estimates and the voluntary promises of production cutbacks. Others—including Seaton—cite the UN optimism as a reason to follow a hands-off line as far as Government action is concerned.

An important sidelight of the UN conference was what impartial observers called a "dogfight" that developed within the U.S. Delegation between industry representatives, who favor tighter trade controls, and those who would like to see existing quotas relaxed or repealed.

BARTER UP, BUT HEADED DOWN—Agriculture Department's Commodity Credit Corp. program of bartering surplus domestic crops for foreign metals and minerals is showing new signs of life—but most experts in Washington regard the new activity as strictly temporary. In fact, they predict further drops in barter deal levels in the future.

First-quarter 1959 contracts signed total nearly $60-million worth of metals and minerals. Agency staffers say new deals for the fiscal year ending the 30th of this month may total $125-million. This is well above recent quarterly totals—the $60-million figure is almost three times the total for the previous three months. The step-up reflects relaxations on tight restrictions in the regulations, which Congress forced on the Agriculture Department last year.

But brokers still complain the procedural requirements are too tight to make much barter worth their while. They also argue that the Government's rigid price schedules are too inflexible to give them bargaining leeway, and are unrealistically fixed.

On top of this, the CCC has cut asbestos, lead and chemical grade manganese from its list of barterable commodities (although it added metallurgical grade manganese ore).

Industry dissatisfaction with the program is growing, and Congress may again investigate—this year or next.

ALUMINUM IMPORT FIGHT BREWING—Aluminum producers, exploring avenues to new import protection in Washington, have kicked off what may develop into a controversial fight. Their drive started last year, amidst overproduction worries and increasing import competition.

Administration officials turned down pleas for various kinds of Government trade restrictions. But now aluminum-state Senators are considering legislation which would embargo all imports of aluminum in base or finished product form. Such a measure, coming in this year's climate of overseas production expansion talk, would split the industry wide open. Many aluminum industry spokesmen are reported to be opposed to any bill which would go this far.

Administration Seeks Some Stockpile Disposal

CENTER OF THE CONTROVERSY over Government stockpile disposal is focusing on new legislative proposal which the Administration was readying to send to Capitol Hill as this issue of E&MJ went to press.

A sweeping bill, the proposed new Federal stockpiling law would change existing Government management of the stockpile in several important ways:

Office of Civil and Defense Mobilization is readying a new piece of legislation which would relax restrictions in the present law on Washington's authority to dispose of excess stockpile items in several ways:

- The bill would set up a single national materials reserve inventory, including all materials now in several stockpile categories: (1) in the supplemental stockpile of foreign metal and mineral commodities received in barter exchange for surplus U.S. crops, (2) in the Defense Production Act inventory of domestic metals and minerals acquired under incentive purchase support programs, (3) the Government's tin stockpile, and (4) Interior Department's inventory of domestic metals bought to support market prices.
- It would establish a new Materials Reserve Inventory. The new organization would take, from the national stockpile, commodities that are now in excess of three goals. Now, commodities in the national stockpile cannot be disposed of without express Congressional approval.
- OCDM, under the new proposal, could sell off any or all of the Materials Reserve Inventory without Congressional approval, although the agency would be required to give Congress 90-days notice of its intent to sell.
- The new legislation would give OCDM greater leeway in administratively judging materials in the national stockpile "obsolescent", and thus removable to the reserve inventory.

The proposal, already approved by the Bureau of the Budget, is sure to raise a storm of protest from domestic mining interests and foreign suppliers as well.

But it may form the basis for a new Congressional compromise which would give the Administration broader disposal authority.

It is now clear that Administration officials who favor at least some disposal of what they have estimated is a $4-billion surplus out of the $8.1-billion total commodity supply-on-hand have won out over those officials who have been arguing against disposal (*E&MJ*, May, 1959, p24).

The big fight now will come in Congress. Mining-bloc Congressmen will for once find willing allies in colleagues who favor foreign aid and trade. Aligned will be representatives of domestic metals processors and consumers, who would like to see current markets eased further, and prices brought down.

For example, it was copper fabricators who originally urged disposal of copper inventories. Likewise, aluminum processors are supporting sales of that metal, and so on across a wide span of metal market participants.

The battle that is now shaping up in Congress will take time. And it will be limited to the extent that even disposal proponents are pledged to recommend disposal only in an "orderly manner" that would not disrupt normal commercial markets.

This means that any Government disposal program is at least months, if not years, away. But the handwriting on the wall was summed up by Rep. Albert Thomas (D-Tex.) when his House Appropriation's committee clipped $49-million off General Services Administration's budget earmarked for replacement purchases of rubber rotated in the stockpile as it deteriorates.

Said Thomas: "If this (Government disposal program) takes 10 years, it will have to take 10 years. But let's get on with it, and get the legislation behind us."

If Thomas' attitude prevails—and Congressional observers are betting it will—some eventual disposal is in the cards.

UN Group Predicts Cuts In World Pb-Zn Output

PRODUCTION CUTBACKS of anywhere from 10% to 20% were voluntarily offered by primary producers and optimistically hailed at the recent lead-zinc conference sponsored by the United Nations in New York last month. The UN group, meeting for the third time on the lead-zinc emergency problem of overproduction and world surplusses, bullishly predicted that 1959 excess output would thus be reduced to 59,000 tons of lead, 16,000 tons of zinc.

Unquestionably the industry voluntary cutbacks were stimulated by the mere "UN presence" of the emergency committee, most experts in Washington agree.

But mining officials in Washington express doubt—first that the UN working group used realistic supply-demand estimate figures in reaching its conclusions, and second that the voluntary curbs will stick.

Significant improvement in international metal markets—which the UN group forecasts—could well mean private companies would then abandon their self-imposed controls and steam once again into overproduction.

Some Government aides feel the long-range study also recommended by the UN conference may do more good in the final analysis to improve the supply-demand balance than the voluntary curbs. The need for better statistics, this school argues, is very real.

Meanwhile, Government mining policymakers are taking a hands-off approach to what some delegates to the UN conference described as a real "dog-fight" that developed between U.S. delegates.

Labor This Month

BARGAINING SHOWDOWN NEARS: The nonferrous negotiations are running up to the wire with some sizable hurdles still in the way. Apart from the wage and fringe demands, several bargaining innovations by the Mine-Mill and Smelter Workers loom ahead; demands that other unions have already scored on. This makes the Mine-Mill leaders more determined to win on two issues—an escalator clause that ties wages to the cost-of-living, and supplementary unemployment benefits that provide company payments to laid-off workers.

Mine-Mill is coming in late with both propositions. Many major industrial unions wrapped these up in previous negotiations and are now at the point of expanding them. It's possible that Mine-Mill came in too late on one—the living cost adjustment. Many companies are displaying disillusionment with this provision on two points—that it feeds inflation by raising wages because living costs go up, and that it just plain costs too much. The United Steelworkers, for instance, collected 9¢ an hour in their escalation agreement over the past three years. This was half their total wage increase. Railroad workers, too, have been winning wage boosts under the Government's consumer price index since 1956. Now, both industries are back in bargaining this year and neither wants to renew these clauses. The unions, on the other hand, insist that they be included in any long-term agreement as a protection against rising prices.

LABOR LOSES LEGISLATIVE GRIP: AFL-CIO leaders, who counted this Congress on their side after last November's elections, are hurting in the legislative arena. The union officials have failed to score in their demands for such legislation as Federal unemployment benefits, extensive aid to depressed areas, minimum wage hike and a number of others. But, even more, they may see some legislation written they don't like. The prospects, at this point, show a Congress determined to come up with anti-racketeering legislation that the unions flatly oppose. The Senate has passed, by 90 to one, the Kennedy-Ervin Bill, the mildest measure from the union viewpoint now on the Hill. And this contains restrictions on union conduct that AFL-CIO president George Meany and associates are resisting outright. Particularly, they dislike the "bill of rights" that gives union members rights of free speech and assembly in union meetings, right to sue union officers and to be free of union punishment. The clause they want most to defeat is the criminal penalty for violating these rights—a $10,000 fine and two years imprisonment. Meany claims that most unions are honest; that their own rules permit union members to speak out without such outside interference.

Congressmen aren't hearing Meany's voice. Those legislators aided by union support in the elections—the union's claim this is two-thirds of Congress—seemed determined to write a bill in the House at least as tough as the Senate's Kennedy-Ervin. The prospects are that it will be tougher. House members are being pressured by constituents to "do something" about labor racketeering that the Senate's McClellan Anti-Rackets Committee has been uncovering over the past two years.

MINE-MILL—A JUMP ON REFORM: Many of the legislation provisions to crack down on the labor rackets deal with the rights of union members to control their own affairs. MMSW took a big step in this direction on its own with recent referendums. The membership voted on these two propositions: that petitions for recall of international officers can be processed if one-quarter of the membership in 25% of the local unions sign up, and that any amendments to the constitution must go to a referendum vote.

THE STOCKPILE STAYS HIGH: At least for the time being. The Government won't unload its copper on the open market. This is the promise Labor Secretary James P. Mitchell made to MMSW president John Clark in a recent letter. Mine-Mill has been promoting the stockpile on its own, apart from industry. While the industry is concerned with what disposal of the stockpile would do to prices, Mine-Mill is wary over what it would do to its current bargaining position.

MARKETS

Industry Awaits Possible Copper Strikes; Lead 12c; Zinc Sales High

The price of non-ferrous metals in the U.S. rose in May to 120.9% of the 1922-'24 average from 120.1% in April according to the E&MJ index of non-ferrous metal prices. The increased price of lead more than offset the slight price drop in copper.

Possible strikes in copper mining in the U.S. was the major uncertainty in the copper outlook. Most contracts are with Mine-Mill and terminate June 30. Kennecott was scheduled to enter into centralized negotiations with Mine-Mill for its major properties the first week of June. Its Garfield smelter and refinery contracts, with the Steelworkers union, terminate July 31. Anaconda and Phelps Dodge major properties are also organized by Mine-Mill and contracts terminate June 30. The Perth Amboy refinery (owned by Anaconda) contract with the Steelworkers ends November 10. The Phelps Dodge Laurel Hill refinery in New York has a contract with the Steelworkers which expires July 31. American Metal's refinery at Carteret is also organized by Mine-Mill with contract termination June 30. Most of Asarco's properties also are with Mine-Mill and have the June 30 date. If Mine-Mill should strike all the copper properties whose contracts terminate June 30 the industry would be almost shut down. The union in the past has settled with the various companies at different dates. In 1952 and 1955 American Metal's Carteret refinery reached agreement with the union and there was no interruption of work. Much of the rest of the industry was struck but finally settled for about the same terms as American Metal.

Views in industry differ widely on the probabilities of strikes. Some feel the union, as is customary, has asked for much more than any company will be willing to offer. Mine-Mill wants in addition to a large wage increase, wage escalation tied to the Bureau of Labor cost of living index, and supplementary unemployment benefits. Many other major unions have these two "fringe benefits" and Mine-Mill may feel its position with the workers in the industry will suffer unless it also gets them. Reports are that much of industry has found them undesirable and management will resist. The union is reported seeking other benefits including a 32-hour week.

Management in copper has not committed itself strongly in advance (unlike management in the steel industries). Some see this, plus the low stock position of the industry, as suggesting the final compromise will be made by management without a strike and with gains to the union of over half of what it asks. Chances are fairly good according to others, that Mine-Mill will work without a contract until the steel industry settlement is arranged (assuming settlement is not reached by June 30) and that it will receive comparable gains. Absence of wage escalation and supplementary unemployment benefits in present Mine-Mill contracts would create some difficulty in determining "comparability." With many the above two reasons for not expecting a strike are unconvincing.

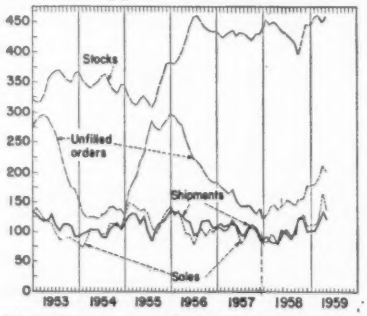
Outside of the U.S. the only labor contracts of significance that end June 30 are Anaconda's properties at Chuquicamata and Antofagasta. But strikes do not occur only at the time contracts end.

Copper sales reported to E&MJ for calculating weighted average prices in May totaled almost 200,000 tons, slightly more than in April. Copper Institute data for April show world deliveries to fabricators of 270,262 short tons. Refined stocks rose 10,630 tons to 329,871. Crude primary output was 266,090 tons and refined output 278,959. Deliveries and output in the U.S. were exceptionally high. Deliveries outside the U.S. were high but down about 11,000 tons from March. Delivery of copper products to customers by U.S. fabricators according to Copper Association data in April dropped to 120,680 tons from 133,259 in March. Many in industry felt the drop was not significant—the March figure they maintain was exceptionally high. Fabricators refined stocks rose to 463,582 tons from 449,441 tons in March.

Producers and custom smelters sold all the copper they wanted to sell in May. Stocks dropped to very low levels. One major producer believed that even if copper buying should stop for a month the producer price would hold at 31½c —producers would merely build up their stocks to a level that would permit prompt shipment of any specified shape.

Custom smelters were at 32c at the end of the month. But some analysts felt they could easily be charging more. Merchants were doing very little business and had been asking 33c. Katanga resumed selling in the U.S. market. It had ceased selling in the winter. On May 22 Katanga raised to 30.15c at main European ports.

U. S. Copper Fabricator Data



U. S. Copper Association data, thousands of short tons through April. Sales, shipments and unfilled orders are for fabricated products. Stocks also include refined copper. Sales and shipments are two months moving averages.

Primary aluminum output in the U.S. in April according to the Aluminum Association was 155,213 short tons; March was 157,189 tons. April 1958 production was 125,000 tons.

Aluminum shipments have been rising. The Aluminum Association reports sheet, plate and foil shipments in April of about 79,000 short tons; in March the same firms reported about 75,000 tons and in January and February about 61,000. Though some of the pick-up may be in anticipation of a strike in aluminum this summer comments from industry spokesmen are that demand for current consumption is largely responsible.

Alcoa announced it will increase output by 40,000 tons annual rate—it will be at 82% of capacity. Reynolds is raising output by 30,000 tons to 93%. Kaiser is reactivating a 22,000 ton potline at Mead, Washington, June 5. This will bring its output to the annual rate of 525,000 tons; its capacity is 609,000. Its fourth potline was scheduled to begin at Ravenswood June 1.

Kaiser is ending freight allowances presumably to eliminate price discounting.

Lead was raised to 12c a lb New York by a major custom smelter May 7. Other sellers followed soon after. Lead sales were exceptionally heavy in April and May. Sales reported to E&MJ for calculating weighted average prices were at record levels both months. The heavy buying reflects various factors. The output cuts resulting from the UN meetings led some to feel prices would rise. Some buyers were not getting their usual supply of secondary metal—this stemmed from some holding of scrap and also of metal produced from scrap. These buyers, and also some secondary sellers, came to primary producers for metal. Smelters apparently sold out most of the metal they had produced from concentrates bought at prices compatible with the lower lead price. A number of sellers say the heavy buying does not reflect consumption—it reflects expectation of strikes holding up shipment of lead.

Zinc sales have been good. In part this reflects good business conditions but some sellers indicate additional reasons. Though few plants are subject to strikes this summer some buying results from the possibility of strikes. Zinc prices have held steady rather than rising and buyers feel they can't go wrong by buying now. Some buyers who ordinarily purchase for one month only have bought ahead for two months. Special High sales spurted with the rise in die casting alloy prices (though many say buyers were "backed in" at the old alloy prices for as much as three months ahead).

Average Prices May *(E&MJ Quotations)*

Copper:

Electro, domestic refinery	31.155
Electrolytic, export refinery	28.814
Electrolytic, c.i.f. Cont'l ports	29.759

Lead:

Common, New York	11.897
Common, St. Louis	11.705

Silver:

Silver, New York, per oz.	91.375
Silver, London, pence per oz.	79.100

Zinc:

Prime, Western, East St. Louis	11.000
Prime, Western, delivered (g)	11.500

Tin:

New York Straits	103.060
Gold, per oz., U. S. price	$35.000
Sterling Exchange	281.454
Quicksilver, per flask	$245.000
Antimony (E&MJ) (d)	32.590
Antimony, bulk, Laredo	29.000
Antimony, in cases, Laredo	29.500
Platinum, refined, per oz.	$77.000
Cadmium (a)	120.000
Cadmium (b)	130.000
Al., 99½ dom., ingot	26.800
export, pag.	22.500
Magnesium, ingot	35.250
Nickel (f)	74.000

Domestic quotations, unless otherwise stated, are in cents per pound. Sterling exchange checks, in cents. Quicksilver, per flask of 76 lb.

(a) Per lb. delivered, ton lots.
(b) Per lb. delivered, small lots.
(d) Domestic 5 tons or more but less than carload lots, packed in case f.o.b. New York
(f) Contract price, f.o.b. Port Colborne U.S. duty included.
(g) Delivered where freight exceeds 0.5c.

"Free Gold Market

International gold trading volume declined 35% in May as no major Soviet sales occurred. Bar prices fell fractionally while coins eased less than 1% in most European markets. Some activity in gold futures transactions was reported from London and Zürich. Continuing American losses dominate all gold discussions. Pick's World Currency Report quotes on "free gold" per fine oz as follows:

	COINS		BARS (12.5 kg)	
	Apr. 30	May 31	Apr. 30	May 31
NEW YORK transit	.....	.....	$35.08½	$35.08½
MANILA	$42.50	$42.10	36.15	36.15
HONG KONG	46.75	46.75	38.95	38.80
BAMBAY	64.50	64.00	64.00	63.50
TANGIER	40.70	40.60	35.25	35.25
BEIRUT	41.05	40.75	35.19	35.18
PARIS	40.10	40.20	35.75	35.54
BUENOS AIRES	38.45	38.50	36.15	36.60

Note: Prices are quoted at the free or black market value of the U. S. dollar in the local markets.

Custom Smelter Copper Price

Based on flat price and E&MJ-average price sales in U. S. for month of May reported by American Smelting & Refining Co.; electrolytic coper in standard shapes, adjusted to nearest ⅛c; ¼c deducted for selling common.

Delivered Consumers' plant	31.625 lb
F.o.b. refinery	31.225 lb

Major Metals

U. S. DAILY AND AVERAGE PRICES

May 1959	Electrolytic Copper (a) Domestic	(b) Export	Europe c.i.f.(c)	Lead New York	Lead St. Louis	Zinc f(Delivered	Zinc East St. Louis	Aluminum Primary Pig 99½% U. S. Dest.	Straits Tin New York
1	31.200	28.575	29.520	11.500	11.300	11.500	11.000	24.700	102.625
4	31.125	28.525	29.470	11.500	11.300	11.500	11.000	24.700	102.625
5	31.150	28.250	29.195	11.500	11.300	11.500	11.000	24.700	102.750
6	31.125	28.275	29.220	11.500	11.300	11.500	11.000	24.700	102.500
7	31.200	28.525	29.470	11.830	11.800	11.500	11.000	24.700	102.500
8	31.150	28.375	29.320	12.000	11.800	11.500	11.000	24.700	102.625
11	31.175	28.325	29.270	12.000	11.800	11.500	11.000	24.700	102.625
12	31.175	28.625	29.570	12.000	11.800	11.500	11.000	24.700	102.625
13	31.175	28.750	29.695	12.000	11.800	11.500	11.000	24.700	103.000
14	31.150	28.700	29.645	12.000	11.800	11.500	11.000	24.700	103.125
15	31.175	28.600	29.545	12.000	11.800	11.500	11.000	24.700	103.125
18	31.150	—No Quote—		12.000	11.800	11.500	11.000	24.700	103.125
19	31.175	28.675	29.620	12.000	11.800	11.500	11.000	24.700	103.125
20	31.150	28.850	29.795	12.000	11.800	11.500	11.000	24.700	103.250
21	31.150	28.750	29.695	12.000	11.800	11.500	11.000	24.700	103.250
22	31.175	29.325	30.270	12.000	11.800	11.500	11.000	24.700	103.500
25	31.125	29.575	30.520	12.000	11.800	11.500	11.000	24.700	103.500
26	31.200	29.225	30.170	12.000	11.800	11.500	11.000	24.700	103.500
27	31.125	29.400	30.345	12.000	11.800	11.500	11.000	24.700	103.500
28	31.100	29.475	30.420	12.000	11.800	11.500	11.000	24.700	103.375
29	31.100	29.475	30.420	12.000	11.800	11.500	11.000	24.700	104.000
AVERAGES FOR MONTH									
May	31.155	28.814	29.759	11.897	11.705	11.500	11.000	24.700	103.060
AVERAGES FOR WEEK									
May									
6	31.165	28.470	29.415	11.500	11.300	11.500	11.000	24.700	102.650
13	31.175	28.520	29.465	11.966	11.800	11.500	11.000	24.700	102.675
20	31.160	28.706	29.651	12.000	11.800	11.500	11.000	24.700	103.150
27	31.155	29.255	30.200	12.000	11.800	11.500	11.000	24.700	103.450
CALENDAR WEEK AVERAGES									
May									
1	31.210	28.725	29.670	11.500	11.300	11.500	11.000	24.700	102.675
8	31.150	28.390	29.335	11.666	11.500	11.500	11.000	24.700	102.600
15	31.170	28.600	29.545	12.000	11.800	11.500	11.000	24.700	102.900
22	31.160	28.900	29.845	12.000	11.800	11.500	11.000	24.700	103.250
29	31.130	29.430	30.375	12.000	11.800	11.500	11.000	24.700	103.575

Silver, Gold and Sterling

DAILY AND AVERAGE PRICES

May 1959	Silver (c) New York	Silver London	Sterling Exchange	Gold (d) London
1	91.375	79.125d.	281.5900	249s. 3d.
4	91.375	79.125d.	281.6500	249s. 3¼d.
5	91.375	79.125d.	281.6400	249s. 3¾d.
6	91.375	79.125d.	281.6200	249s. 5½d.
7	91.375	79.125d.	281.6200	249s. 4¼d.
8	91.375	79.125d.	281.6400	249s. 4¼d.
11	91.375	79.125d.	281.6200	249s. 4½d.
12	91.375	79.125d.	281.5900	249s. 6¼d.
13	91.375	79.125d.	281.5700	249s. 7d.
14	91.375	79.125d.	281.5500	249s. 7¾d.
15	91.375	79.125d.	281.5100	249s. 7d.
18	91.375	Holiday	281.5100	Holiday
19	91.375	79.125d.	281.4000	249s. 6¾d.
20	91.375	79.125d.	281.2600	249s. 8¼d.
21	91.375	79.125d.	281.2500	249s. 9d.
22	91.375	79.125d.	281.3600	249s. 8¼d.
25	91.375	79.125d.	281.3000	249s. 7½d.
26	91.375	79.125d.	281.2700	249s. 7¾d.
27	91.375	79.125d.	281.2900	249s. 6½d.
28	91.375	78.875d.	281.1700	249s. 7d.
29	No Quote	78.875d.	281.1300	249s. 8¼d.
AVERAGES FOR MONTH				
May	91.375	79.100d.	281.454	—
AVERAGES FOR WEEK				
May				
6	91.375	—	281.616	—
13	91.375	—	281.608	—
20	91.375	—	281.446	—
27	91.375	—	281.294	—

Calendar Week Averages: New York Silver: May 1, 91.375; May 8, 91.375; May 15, 91.375; May 22, 91.375; May 29, 91.375.

THE above quotations for major non-ferrous metals are our appraisal of the important United States markets, based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis. All prices, except gold and silver, are in cents per pound.

(a) Net prices at refineries on Atlantic seaboard. To arrive at the delivered New England basis add 0.0400c per pound, the average differential for delivery charges. ... ...

(b) Export copper daily quotations are weighted averages based on sales outside the U.S. reported to E&MJ. Ocean freight and 0.125c lighterage and handling are deducted to arrive at the f.o.b. Atlantic seaboard refinery quotation. On f.a.s. U.S. sales lighterage of 0125c is deducted.

(c) The c.i.f. Continental ports quotation is arrived at by adding to the f.o.b. export quotation lighterage, and the standard conference freight and insurance, Atlantic ports to main Continental ports. Currently this is 0.125c and 0.82c.

Copper, lead and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

Quotations for copper are for the ordinay forms of wirebars and ingots; cathodes are sold at a discount of 0.125c to 0.15c per pound. Quotations for zinc are based on Prime Western brands. Zinc in New York commands a premium over the St. Louis basis equal to the freight differential. Contract prices for High Grade zinc delivered in the East, Middle West, and West effective April 9, 1958, commanded a premium of 1c per pound over the current market for Prime Western; Special High Grade 1.25c effective April 9, 1958.

(f) Prime Western delivered where freight from E. St. Louis exceeds one-half cent.

Quotations for lead are based on domestic common lead. Corroding lead commands a premium of 10 points (almost all U. S. lead is corroding grade).

(c) The daily silver quotations reported by Handy & Harman, in cents and fractions of a cent per troy ounce, is the price paid by Handy & Harmn in settlement for silver contained in unrefined silver-bearing materials submitted to them for refining. It is determined on the basis of offers of bar silver .999 fine as made to Handy & Harmn for nearby delivery at New York by regular suppliers in quantities sufficient to meet daily requirements, and it is usually one quarter cent below the price at which such offers are made.

The Treasury's purchase price of newly mined domestic silver is 90.5 per troy ounce 1000 fine effective July 1, 1946. London silver in pence per troy ounce, basis .999 fine.

(d) U. S. Treasury's gold price is $35. Actual payment by the United States Treasury for gold is at 99.75 per cent of the price quoted by the Treasury, which is equal to $34.9125.

MARKETS *(Continued)*

London Metal Exchange Quotations

May	COPPER Cash Bid	COPPER Cash Asked	COPPER 3 Mo. Bid	COPPER 3 Mo. Asked	LEAD Current Month Bid	LEAD Current Month Asked	LEAD 3 Mo. Bid	LEAD 3 Mo. Asked	ZINC Current Month Bid	ZINC Current Month Asked	ZINC 3 Mo. Bid	ZINC 3 Mo. Asked	TIN Cash Bid	TIN Cash Asked	TIN 3 Mo. Bid	TIN 3 Mo. Asked
1	233¼	233½	234¼	234½	69¼	69⅜	70⅛	70⅜	73⅝	73⅞	73⅝	73⅞	783½	784½	783½	784½
4	232½	232½	233¾	234	70	70⅛	71	71⅛	74½	75	74¼	74½	783	783½	783½	784
5	230½	230½	232	232¼	70⅝	70¾	71⅜	71⅞	75	75¼	74½	74¾	783½	784	784	784½
6	232¼	232½	233¾	234	71⅛	71¼	72⅛	72¼	76¼	76½	75¼	75½	783½	784	784	784½
7	233¾	234	235¼	235½	70⅝	70¾	71¾	71⅞	75½	76	74½	74¾	783½	784	784½	785
8	230½	230¾	232¼	232½	70	70¼	71¼	71½	76	76¼	74¾	74¾	782½	783	782½	783
11	233¾	234	234½	234¾	72	72¼	72½	72¾	77½	77¾	76¼	76½	783	783½	784	784½
12	234½	234¾	235½	235¾	72⅞	73	73	73⅛	78	78½	76	76¼	783½	784	784	784½
13	235½	235¾	236½	236¾	71½	71⅝	71¾	72	77½	77⅝	75¾	75¾	784	785	785½	786
14	233¼	233½	234¼	234½	71	71⅛	72	72¼	77½	77¾	75¾	76	784	784½	784½	785½
15	234½	234¾	235¾	236	71⅝	71¾	72¼	72⅝	78	78¼	76¼	76½	784	784½	784½	785
18	HOLIDAY															
19	236¼	136½	237½	237¾	71⅝	71½	72¼	72¼	78	78¼	76	76¼	783½	784	784	784½
20	237	237½	238	238¼	71¼	71⅜	72	72⅜	78	78¼	76	76¼	784	784½	784½	785
21	238	238¼	237¾	238	70½	70⅝	71⅜	71¼	77½	77⅝	75½	75⅝	784½	785	785	785½
22	241¼	241½	239¾	240	70¼	70⅜	71	71¼	78¼	78⅝	76½	76½	785	785½	785	785½
25	244	244¼	241¾	242	70¼	70⅜	71	71⅛	79¾	80	77½	77¾	785	785½	785	785½
26	238½	238¾	237	237¼	70	70¼	71	71¼	78½	78¾	76½	76¾	784½	785	784½	785
27	240¾	241	239½	239¾	69¾	69⅞	71	71⅛	79½	79⅝	77¼	77¾	785	785½	784½	785
28	241	241¼	240¼	240½	70¼	70⅜	71½	71⅝	78¾	79	77⅜	77⅝	784	785	784	784½
29	241	241¼	239¾	240	69½	70	71½	71¾	77	77¼	76¼	76¾	785	785½	784	785
Av'g's	£236.206		£236.575		£70.800		£71.691		£77.353		£75.875		£784.213		£784.538	

Prices are for the official a.m. session in pounds sterling per ton of 2240 lb. Copper basis wire bars, lead 99.97%, zinc 98% and tin min. 99.75%.

Miscellaneous Metals, Ores, Minerals

Quotations cover wholesale lots, prompt shipments, f.o.b. New York unless otherwise stated, tons of 2,000 lb. unless otherwise noted. St—short ton; lt—long ton. (p) duty paid.

MISCELLANEOUS METALS

May 31, 1959

Aluminum ingot, 99 plus % lb.			26.8¢
Antimony, spot, lb., less than carload, in cases			32.59¢
In bulk, carload lots, f.o.b. Laredo			29.00¢
Imported, 10 ton min. (p), 99½%			24¢
Bismuth, ton lots, lb.			$2.25
Cadmium, small lots, commercial sticks, delivered, lb.,			$1.20
small lots			$1.30
Calcium, lb., ton lots, 98%, cast			$2.05
Chromium, 97% grade, lb., contract del.			$1.29
Cobalt, 97 to 99%, per lb. eff. Feb. 1, 1957			$1.75
Germanium, per gram, 10,000 gram lots	(d) 33¢	@(c)(d)	35¢
Indium, troy oz.	$1.25	@	$2.25
Lithium, lb., 98%	$9.00	@	$11.00
Nickel, cathodes, lb. (a)			74¢
Other sales, reg. sellers			74¢
Sales by dealers, etc.			74¢
Magnesium, 99.8% carloads, lb. producer's plants, Velasco, Texas eff. Apr. 16			35¼¢
Palladium, troy oz.	$18.00	@	$20.00
Platinum (wholesale lots), troy oz.	$76	@	$80
Quicksilver flask of 76 lb. 25 flasks or more	$245	@	$249
Selenium, 99 plus %, lb.—(Feb. 19, 1958)			$7.00
Silicon, minimum 97%, carloads, lb.			21½¢
Semi Conductor grade, lb.			$350
Tellurium, lb.			$2
Thallium, 100 lb. or more lb.			$7.50
Titanium, 99.3 plus, grade A-1, max. 3% iron, lb. (b)	$1.62	@	$1.82

(a) Eff. Dec. 6, 1956; incl. U. S. duty; (b) Effective Oct. 1, 1958. (c) Delivered; (d) f.o.b. plant.

METALLIC ORES

Beryllium Ore, imported, 10% BeO, (b) stu: spot			$30
term contracts	$31	—	$32.25
Chrome Ore per long ton, f.o.b. cars Atl. ports, dry:			
44% Cr_2O_3 no ratio	$19	@	$20
48% Cr_2O_3 3 to 1 ratio	$40	@	$46
Iron Ore, Lake Superior, Lower Lake ports, long ton:			
Old Range bessemer			$11.85(e)
Mesabi bessemer			$11.60(e)
Mesabi non bessemer			$11.45(e)
Lead (Galena), 80%, Joplin, Mo., ton			$141.72
Manganese Ore—Per long ton unit of Mn basis 48% manganese, nearby positions, subject to premiums and penalties, c.i.f. U. S. ports import duty extra. 87¢—90¢. Long-term contract nominal. Indian Gov't export duty discontinued Nov. 24, 1958.			
Molybdenum Ore, 90%, per lb. of Mo f.o.b. mines			$1.25
Columbium-Tantalum, per lb., combined oxides 10 to 1 ratio	$1.10	@	$1.15
Tungsten Ore, per stu of WO_3:			
Foreign 60%, c.i.f. U. S. ports, duty extra	$12.50–$13.00		
U. S. scheelite, f.o.b. mill	$20½	@	(a)$22
Vanadium Ore, per lb. of contained V_2O_5 f.o.b. mines			31¢
Zinc Ore, Prime, 60% concentrate, Joplin, Mo., per ton.			$64

(a) Nominal. (b) c.i.f. U. S. ports. (e) Eff. 1958 shipping season.

METALLIC COMPOUNDS

Arsenous Oxide (arsenic trioxide) lb., in bbl. carload lots N. Y. docks			4–5¢
Cobalt Oxide, 72½% to 73½%, per lb. eff. Dec. 1, '56.	$1.33	@	$1.36
Copper Sulphate, 100 lb. eff. Oct. 24, '58			$12.30
Germanium Dioxide, gm.			18½¢
Molybdic trioxide, technical, per lb. of Mo	$1.46	@	$1.47
Imported, incl. 37¢ duty	$1.75	@	$2.05

ALLOYS

Ferrochrome 65 to 70%, per lb. of Cr, (4-9% C)			28¾¢
Ferromanganese, 74 to 76%, per lb., shipg. pt.			12¾¢
Ferromolybdenum, 58 to 64% Mo lb. of Mo contained	$1.50	@	$1.82
Ferrosilicon, 50% per lb. of Si f.o.b. shipping point (3-1957)			14.60¢
Ferrotungsten, 72 to 82%, lb. of W contained			$2.15
Ferrovanadium, per lb. of V delivered	$3.20	@	$3.40
Silicomanganese, max. 1½% carbon, lb. contracts			12.8¢
Spiegeleisen, per long ton, 10 @ 21% grade eff. Jan. 7.			$102.50

NON-METALLIC MINERALS

Asbestos, f.o.b. Canada (Quebec) mines (Canadian funds) ton:			
Crude No. 1	$1,400	@	$1,810
Crude No. 2	$750	@	$1,155
Spinning fibers	$370	@	$600
Shingle fibers	$180	@	$220
Paper stock	$120	@	$145
Waste	$75	@	$86
Shorts	$40	@	$75
Asbestos, f.o.b., Vancouver, B. C. (Canadian funds):			
Crude No. 1			$1,522
Spinning fibers	$220	@	$787
Asbestos, Vermont, f.o.b. Morrisville:			
Spinning fibers	$370	@	$428
Shingle stock	$181	@	$200
Paper stock	$120	@	$152
Waste, stucco or plaster			$86
Refuse or Shorts	$41	@	$75
Barytes f.o.b. cars:			
Georgia, crude, per ton			$18
Missouri, 94%, BaSO, per short ton	$16	@	$18
Crude oil well grade, min. 4.3% sp. gravity, st (a)			$18
Imported, c.i.f. Gulf Ports, st	$16	@	$18
Bauxite, long ton, f.o.b. point of shipment:			
Domestic, crude, 50 to 52% (not dried)	(c)$ 5.00	@	$5.50
Domestic, chemical, 55 to 58%	(c)$ 8.00	@	$8.50
Domestic, abrasive, 80 to 84%	(c)$18.00	@	$18.50
Imported metallurgical, per lt. f.o.b. Br. Guiana, dep. on grade			$7.14
Feldspar, bulk ton:			
Potash or soda feldspar, 200 mesh, ceramic grade			$20.50–$21
Glass feldspar, white, 20 mesh			$9
Fluorspar, f.o.b. mines, bulk, 72½% effective, ton	$37	@	$41
60% effective CaF_2	$33	@	$36.50
Acid 97% concentrate, bulk, ton (eff. 12–1–56)			$50.00
Fuller's earth, f.o.b. Georgia or Florida, ton	$7.00	@	$14.00
Magnesite, per ton dead-burned, bulk, f.o.b. Washington			$46
Mica—Domestic, f.o.b. mines. Punch 7¢ to 12¢ per lb. according to size and quality. Sheet clear 1½ x 2-inch, 70¢ to $1.10; x 2 2-inch, $1.10 to $1.60; 2 x 3-inch, $1.60 @ $2.10; 3 x 3-inch, $1.80 @ $2.30; 3 x 4-inch, $2.00 @ $2.60; 3 x 5-inch, $2.60 @ $3.00; 4 x 6-inch, $2.75 @ $4.00; 6 x 8-inch, $4.00 @ $8.00. Wet ground, very fine, $140 @ $155 per ton. Bulk sales, dry ground; $30 @ $55 per ton. Scrap $20 @ $30.			
Ocher, Georgia, ton in sacks	$26.50	@	$32.00
Purites, Spanish, per long ton unit of S. c.i.f. atlantic ports			Not quoted
Sulphur, per lt. f.o.b. U. S. mines: bright			$23.50
dark			$22.50
Mexican, for use in Mexico, per metric ton, f.o.b. mines, 280 to 395 pesos, depending on use	$22.40	@	$31.60
For export f.o.b. vessel, lt. dep. on grade	$22	@	$24
Talc, f.o.b. works, ton:			
New York, purified	$18.00	@	$20.00
Vermont, extra fine			$12.50
Tripoli, Missouri, ton:			
40-mesh, cream colored			$50.00

(a) Some restricted sales at $11.50, (b) Corrected. (c) Nominal.

IRON AND STEEL

Pig Iron, gross ton, basic, Valley Furnaces			$66.00
Steel, f.o.b. Pittsburgh, billets, net ton			$80.00
Structural shapes, Pa., Ala., etc. 100 lb.	$5.30	@	$5.50

ENGINEER'S FIELD REPORT

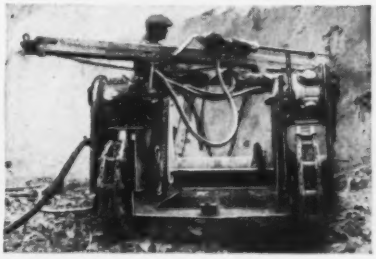
PRODUCT **CHEVRON VISTAC OIL**

FIRM **NEVADA-MASSACHUSETTS COMPANY**
Tungsten, Nevada

Special Oil holds wear to minimum for 15 yrs.

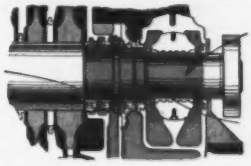
Nevada-Massachusetts Co., operators of one of the world's largest tungsten mines, has relied on Chevron Vistac Oil for 15 years, to keep their rock drills and other air tools operating at peak efficiency. "We use Vistac because it stays on the tools whether they're wet or dry. Doesn't create drag, either...we get full power with minimum tool wear," says general manager Eldridge Nash. Oil's tough, protective film resists high operating temperatures, helps this firm's rock drills (above) bore fifteen 2½-inch blasting holes averaging twelve feet in depth, in just eight hours. Nevada-Mass. does extensive underground mining at this site as well as surface operations.

Despite heavy abrasive dust from drilling in Hornfels and Scheelite, (above), Chevron Vistac Oil keeps rock drills working smoothly. Lubricant is used in 60 rock drills, 3 wagon drills, plus 25 tuggers (air motors) on hoist equipment, loaders, slusher hoists and sump pumps.



Special wagon drill, built at mine, uses Ingersoll Rand DA 35 rock drill to bore horizontal holes up to 18 ft. deep. EIMCO air motors lubricated with Chevron Vistac Oil power tracks for fast and easy maneuvering.

Why Chevron Vistac Oil cuts costs in air-tool equipment



- Atomizes quickly and completely—carries evenly over all parts. Prevents excessive fogging and has no unpleasant odor.
- Additives help form tenacious, oily, pressure-resistant film in wet or dry conditions—cuts wear and power loss.
- Resists high temperatures and oxidation. Stays fluid at low temperatures.

For More Information on this or other petroleum products, or the name of your nearest distributor, write or call any company listed.

CHEVRON Industrial Lubricants

TRADEMARKS "CHEVRON," "VISTAC" AND CHEVRON DESIGN REG. U.S. PAT. OFF.

STANDARD OIL COMPANY OF CALIFORNIA,
225 Bush Street • San Francisco 20, California

THE CALIFORNIA COMPANY,
P. O. Box 780 • Denver 1, Colorado

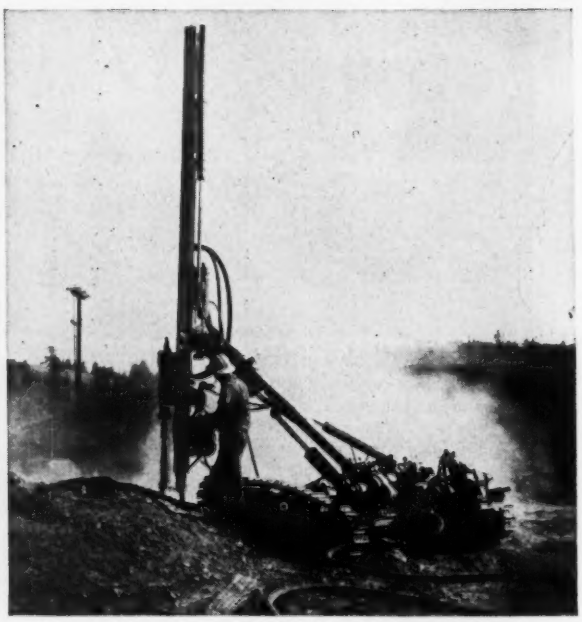
STANDARD OIL COMPANY OF TEXAS
P. O. Box 862 • El Paso, Texas

HARD-HITTING DRILLS

THE SIZE, THE POWER AND

5½" hammer diameter—Here's deep hole drilling power that packs plenty of punch. Gardner-Denver DH143 fills the rock drill gap between wagon drill and rotary rig.

Tough and long-lasting—Gardner-Denver drill steel. Emergence from heat-treat furnace shows carburizing process that results in abrasive-resistant exterior and tough inner core.



First choice in crawler drills—The versatile swing-boom "Air Trac"®. Now available in a variety of models including stiff- and swing-boom units with complete hydraulic components.

FOR ANY ROCK BLAST

THE SPEED YOU NEED

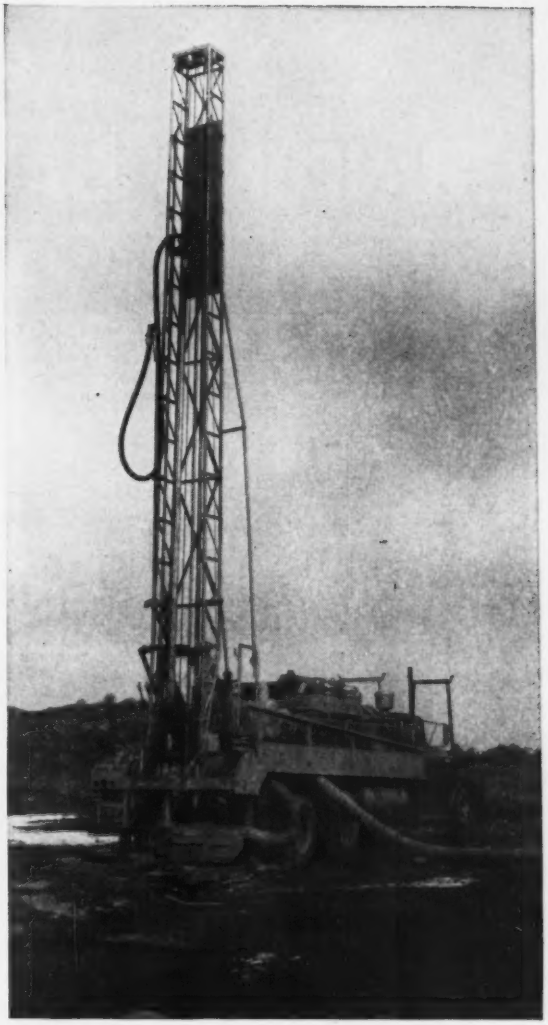
Select your rock drills from the most complete line of drifters in the field . . . GARDNER-DENVER

Gardner-Denver offers the most complete range of drifter drills known, thus assuring the right drill for your application, regardless of what it may be.

Talk to a Gardner-Denver blast hole specialist before you buy new rock drills. His experience can help you select the best blast hole plan and the right equipment for the job from Gardner-Denver's complete line of drills, rigs, steel and accessories.

MIDNIGHT MISSION

When unexpected developments demand immediate attention (additional equipment, essential parts, special service), a Gardner-Denver man is ready to go—any time, anywhere. And at Gardner-Denver, there's no substitute for men—our 100-year philosophy of growth.



In-the-hole power for rotary rigs—New Gardner-Denver "Mole-Dril"* rides with the bit through rock . . . delivers more striking power than any other drill of its size.

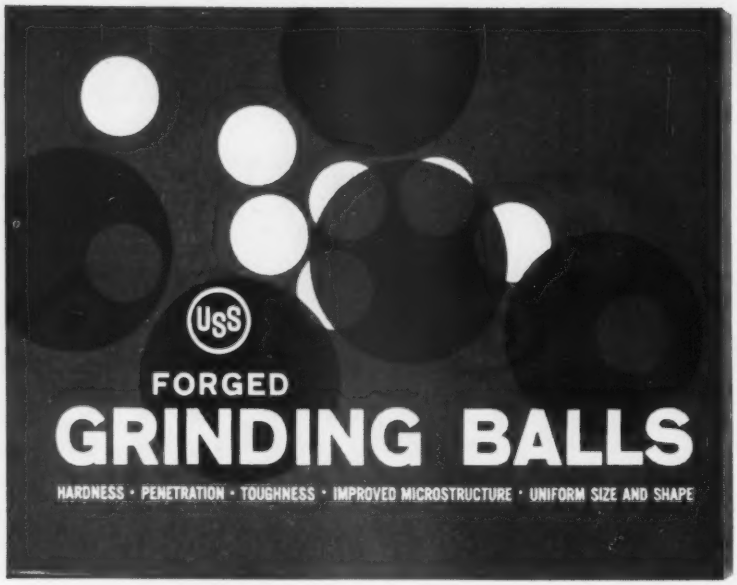
GARDNER-DENVER Since 1859 100 1959 YEARS

EQUIPMENT TODAY FOR THE CHALLENGE OF TOMORROW

GARDNER-DENVER

Gardner-Denver Company, Quincy, Illinois
Export D[illegible] Broadway, New York 7, New York
In Canada: Gardner-Denver Company (Canada), Ltd., 14 Curity Avenue, Toronto 16, Ontario

*Trade-Mark



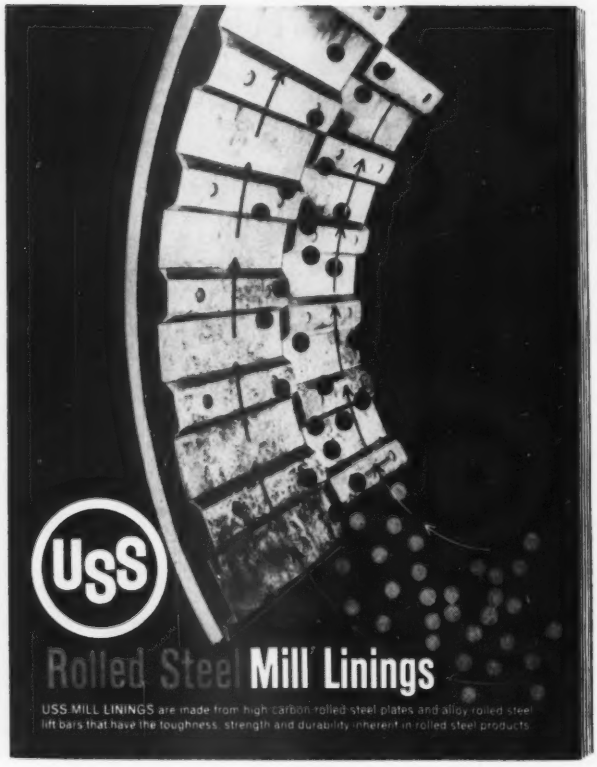
This 16-page booklet not only shows you how USS Forged Steel Grinding Balls are made, but also includes hardness penetration charts and engineering data for the two types of grinding balls that are available—USS Carbon-Manganese and USS Alloy Steel.

These new FREE booklets . . .

give you valuable information on

USS Forged Grinding Balls

and USS Rolled Steel Mill Linings


USS
Rolled Steel Mill Linings
USS MILL LININGS are made from high carbon rolled steel plates and alloy rolled steel lift bars that have the toughness, strength and durability inherent in rolled steel products

This booklet has 20 pages packed full of photos, drawings and engineering data on USS Rolled Steel Mill Linings. It shows you why you get greater efficiency and economy in your grinding mills when you use these tough, wear-resistant, high-carbon rolled Steel plates and heat-treated alloy steel lift bars. To obtain free copies of these booklets write to United States Steel, Room 6010, 525 William Penn Place, Pittsburgh 30, Pennsylvania.

USS is a registered trademark

United States Steel Corporation—Pittsburgh
Columbia-Geneva Steel—San Francisco
Tennessee Coal & Iron—Fairfield, Alabama
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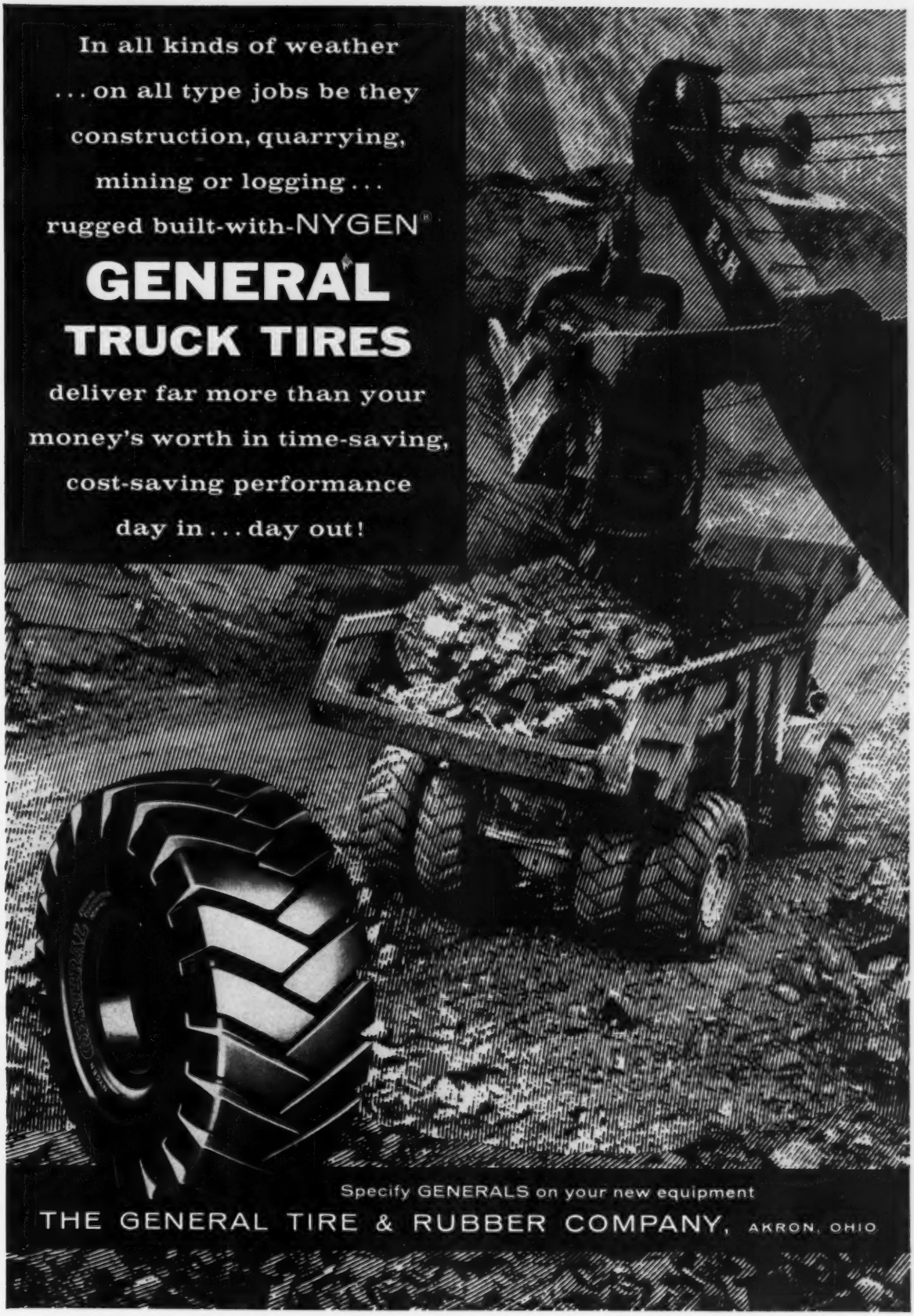
United States Steel

USS

In all kinds of weather
. . . on all type jobs be they
construction, quarrying,
mining or logging . . .
rugged built-with-NYGEN®

GENERAL
TRUCK TIRES

deliver far more than your
money's worth in time-saving,
cost-saving performance
day in . . . day out!



Specify GENERALS on your new equipment

THE GENERAL TIRE & RUBBER COMPANY, AKRON, OHIO

AERO FINDS ORE

New Electromagnetic Detector helps uncover deposits in speedy treetop level surveys

AERO'S latest airborne exploration tool now supplements reconnaissance surveys with accurate, low-level, detailed work so precise that often little or no ground follow-up is needed.

The AERO/Newmont Electromagnetic Detector, mounted in our helicopter together with Airborne Magnetometer and Scintillation Counter, provides complete coverage regardless of rugged terrain.

The ratio of the in-phase response to the out-of-phase response in the new Electromagnetic Detector gives a valid indication of the relative conductivity of the anomalous zones. Surveys in northern New Brunswick, for example, showed that it is relatively easy to separate graphitic zones from massive sulphides. The out-of-phase response was very marked over both graphites and massive sulphides. The in-phase response, however, was zero over the graphites and very pronounced over the massive sulphides.

SEND FOR UNEDITED COPIES OF FIELD RECORDS

On request, we will be glad to send you our brochure containing unedited copies of our original field records from the New Brunswick surveys. Write for "*Detailed, Low Level Prospecting*" today.

AERO SERVICE CORPORATION

Oldest Flying Corporation in the World

Philadelphia 20, Pa.

AIRBORNE GEOPHYSICAL STUDIES • PRECISE AERIAL MOSAICS • TOPOGRAPHIC MAPS • PHOTO INTERPRETATION • RELIEF MODELS

Ask your Allis-Chalmers dealer to show you **"And a Great Deal More"**

TL-14 TRACTOLOADER.

Buckets: 1 to 3-yd
Carry Capacity: 5,300 lb
Maximum Lifting Capacity: 11,000 lb
Breakout Force: 17,800 lb
Weight: 14,480 lb
Engine: Allis-Chalmers
81.5 hp — Diesel
86 hp — Gasoline

NEW! *medium-size Tractomotive Loader*

with all the working advantages of larger TRACTOLOADERS

- **Big 5,300-lb Carry Capacity**
- **A Family of Buckets to Choose From**

You can really "go to town" moving material with this completely new, medium-size TL-14 TRACTOLOADER.

You can carry as much as 5,300 lb every trip in a bucket that is just the right size for the material you are handling . . . get the highest possible production.

There's a whole family of buckets to choose from — 1 to 3-yd — for heaviest to lightest materials. Your Allis-Chalmers dealer has a list of materials and their weight per cu yd. He will help you select the most practical size bucket for your work.

In addition, you get all the operating advantages of the larger TL-20 and TL-16 TRACTOLOADERS: Such as a full power-shift transmission with *exclusive* ONE-LEVER SPEED AND DIRECTION CONTROL for faster cycles. Longer Reach . . . Greater Stability . . . Strong, Pin-Connected Planetary Axles . . . Safe Dump Cylinder Location . . . Fully Protected Hydraulic System . . . "Hi-Traction" Differentials!

Let your Allis-Chalmers dealer tell you all about this completely new TL-14. Let him show you how it can increase your production, cut your cost. You'll be glad you did.

ALL TRACTOMOTIVE EQUIPMENT IS SOLD AND SERVICED BY YOUR ALLIS-CHALMERS DEALER

TRACTO—
a sure sign
of modern design

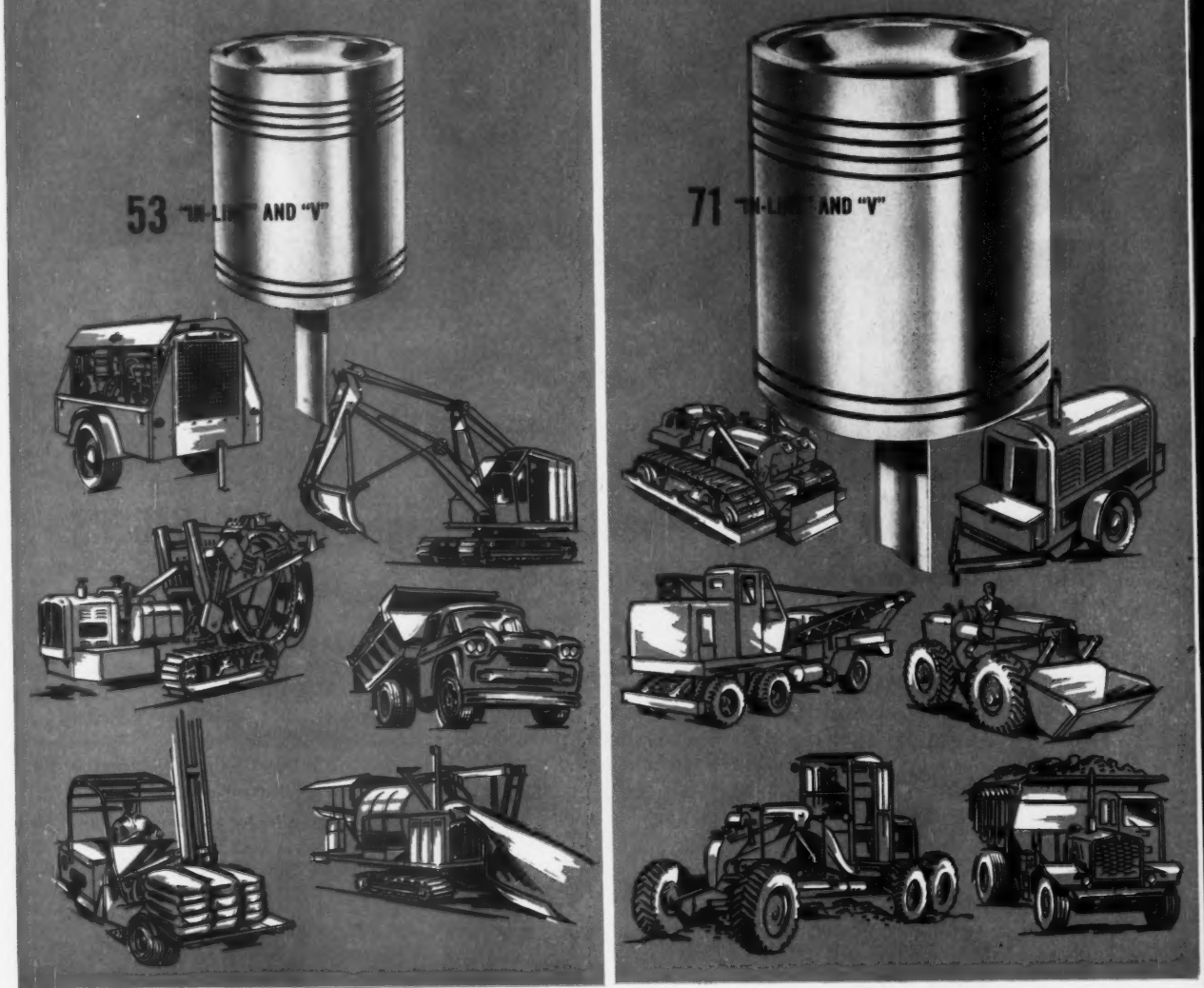
TRACTOMOTIVE
TRACTOMOTIVE CORPORATION • DEERFIELD, ILLINOIS

TRACTOLOADERS • TRACTOSHOVELS • TRACTORIPPERS • TRACTOHOES • TRACTOSIDEBOOMS

MINE OPERATORS SAVE MONEY BY STANDARDIZING ON THE

all purpose

(20 TO 1650 H.P. IN



THE GM DIESEL ALL-PURPOSE POWER LINE
20 to 1650 H.P.
in only 3 cylinder sizes

NON TURBOCHARGED RATINGS

power line

ONLY 3 CYLINDER SIZES)

"Jimmy" Diesel parts... highest interchangeability ...lowest cost

Looking to shave your costs and boost your profits? Then take a close look at the savings you'll make when you standardize on the GM Diesel All-Purpose Power Line—particularly when it comes to buying parts.

For instance, when you buy a cylinder kit assembly (rings, pistons, liner, piston pin) for a "Jimmy" you'll save $40.97 over engine "A," $26.84 over Diesel "B" and $12.39 over engine "C."

And when you buy from your GM Diesel distributor you get parts of the highest quality with latest improvements designed and built to keep your "Jimmy" running right.

Or take parts stocks. A "Jimmy" fleet works with fewer spare parts than any other Diesel for one simple reason—highest parts interchangeability. In fact, three cylinder sizes cover the entire power range from 20 to 1650 H.P.—many parts for a 33 H.P. GM Diesel also fit a 1650 H.P. "Jimmy."

What's more, a "Jimmy" gives you a smaller, lighter Diesel with more guts and go than any other engine.

Add up the score—power, price, parts, performance—and you get only one answer: *It pays to standardize on "Jimmy" Diesel power.* Why don't you?

***Only* your GM Diesel Distributor has all the latest genuine "Jimmy" parts**

GM DIESEL

DETROIT DIESEL ENGINE DIVISION,
GENERAL MOTORS, DETROIT 28, MICH.

In Canada: GENERAL MOTORS DIESEL LIMITED, London, Ontario
Parts and Service Worldwide

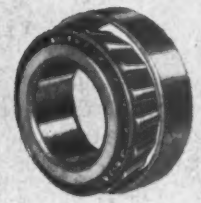
The Positive Seal
PERMA-SAFE
Wheel

Truck wheels, front idlers, support rollers on all models of Allis-Chalmers crawler tractors

Lubricated at factory need no further greasing

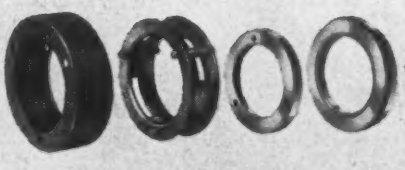
Every Allis-Chalmers crawler tractor—whether produced today or any time during the past 17 years—offers its owner the twin secrets of permanent lubrication.

1



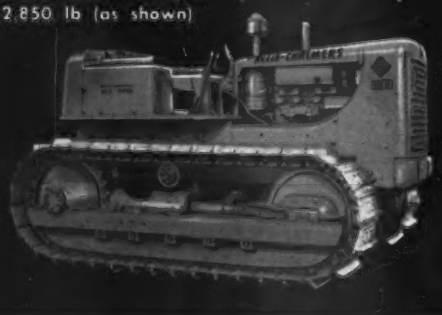
Allis-Chalmers tapered roller bearing wheels roll much more freely than ordinary bushing types . . . reduce power-robbing friction . . . give you more of your engine's horsepower at the drawbar or moldboard where it pays off in production. The tapered roller bearings maintain precise alignment of all parts . . . protect the perfect seal by minimizing side thrust and wobble . . . eliminate the uneven wear that makes positive sealing of bushing-type assemblies impractical.

2



The "Positive Seal" that makes permanent lubrication possible is effected by two steel sealing rings working in combination with the tapered roller bearings. These two rings, smoother than glass, are held firmly together by strong steel coil springs. One seal remains stationary; the other turns with the truck wheel. These seals are micro-finished to near perfect flatness. Their surfaces fit together so precisely that nothing can get through . . . a perfect seal.

HD-6
66.5 net engine hp
12,640-lb drawbar pull
12,850 lb (as shown)



HD-11
99 net engine hp
20,470-lb drawbar pull
21,900 lb (as shown)

Safe, permanent lubrication of truck wheels, front idlers and support rollers requires seals that will keep all moisture and other foreign materials out . . . the lubricant in. Only Allis-Chalmers offers seals which are positive because of their use in combination with tapered roller bearings. The Allis-Chalmers Positive Seal, tapered roller bearing design has been proved in the field through more than 20 years . . . through millions upon millions of operating hours. When introduced in 1938, this outstanding design replaced bushing-type assemblies similar to those used today in other tractors. Allis-Chalmers abandoned bushing-type truck wheels because, in its opinion, they could not be positively sealed.

Your Allis-Chalmers dealer will be happy to help you estimate the savings in time and material that are yours with Allis-Chalmers permanent lubrication. See him today. Allis-Chalmers, Construction Machinery Division, Milwaukee 1, Wisconsin.

move ahead with ALLIS-CHALMERS

...power for a growing world

"Our Ford F-800's, pulling 20-ton payloads, give us mighty good service!"

says R. Dillard Teer, Vice President
Nello L. Teer Co., Durham, N. Carolina

"We operate about 115 Ford Trucks ranging in size from ½-ton pickups to Tilt Cab Tandem tractors. We believe in carefully fitting the truck to the job to be done and usually stay within the manufacturer's recommended ratings. We make an exception to this rule with our Ford F-800's, pulling 20-ton loads in aluminum trailer dumps to our quarry and crushing setup at Durham, North Carolina. These units are carrying the maximum legal limit and give us mighty good service!

"We haven't traded any trucks in about 6 years. It just happens that our company has been growing so rapidly that when we buy a new truck, usually an F-800, I put it under one of our trailer dumps. Then I'll take the old truck, lengthen the chassis, and make a grease outfit or a water wagon out of it. I would say out of over a hundred Ford units in the past 7 or 8 years, we have gotten rid of only a dozen altogether—and some of these were wrecked or burned.

"Another reason we use Fords is that this business is rough on trucks, so parts availability is very important. Our experience over the years with Ford as compared to Ford competitors has been definitely in favor of Ford on parts."

NOW! CERTIFIED PROOF!

FORD TRUCKS COST LESS

'59 Ford Pickups beat average mileage of other leading makes by 25.2% in Economy Showdown U.S.A.

Here at last is certified proof of the differences in gas mileage between six-cylinder pickups . . . evidence that you can use in your operation.

It was compiled by America's foremost independent automotive research firm after testing 1959 six-cylinder, ½-ton pickups of the six leading makes. All trucks were bought from dealers—just as you would.

The tests paralleled every kind of driving—high speeds and low, open highways and city traffic, even door-to-door delivery. And in every test, '59 Ford Sixes delivered more miles per gallon than any other make. Here are the actual percentages:

'59 FORD PICKUP SIXES GAVE

42.6% better mileage than make "D"
31.1% better mileage than make "I"
25.2% better mileage than make "C"
22.0% better mileage than make "S"
9.6% better mileage than make "G"

Taken together, Ford got 25.2% more miles per gallon than the average of all other leading pickups!

What's the secret of Ford's economy? First, of all pickup sixes, only the Ford Six has modern Short Stroke design which reduces friction and requires less fuel. Second, to this modern engine, Ford has added a new economy carburetor to meter fuel more precisely in both high- and low-speed ranges.

See your Ford Dealer for the full report of Economy Showdown U.S.A. and get the whole story firsthand.

All tests conducted and results
CERTIFIED
by America's foremost independent automotive research organization*
***NAME AVAILABLE ON REQUEST**
Send inquiry to P.O. Box 2687, Ford Division
Ford Motor Co., Detroit 31, Michigan

Now! During Dividend Days at your Ford Dealer's...Go *FORD*-ward for Savings

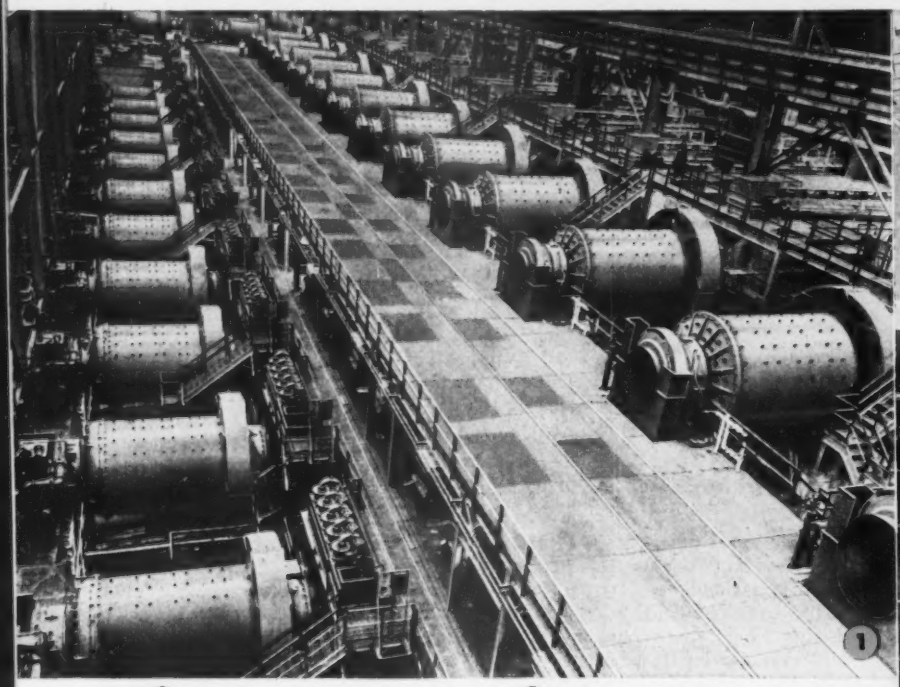
To Increase Production and Lower Operating Costs...Specify NORDBERG MINING MACHINERY

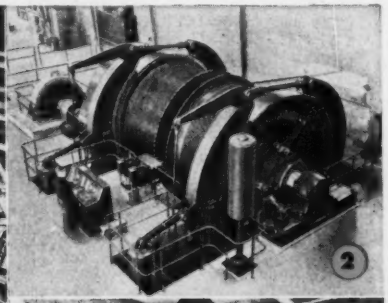
The complete line of heavy-duty Nordberg mining machinery includes Symons® Gyratory Crushers for primary breaking; Symons Cone Crushers for secondary and tertiary crushing; Grinding Mills; Symons Vibrating Grizzlies and Screens; Mine Hoists; and Nordberg Engines for mine and mill power.

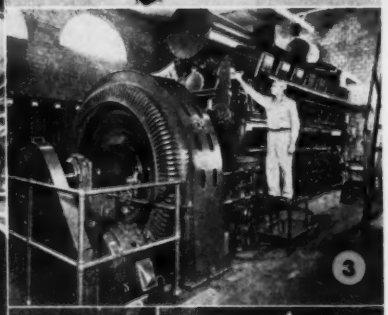
Rugged, heavy duty construction of Nordberg mining machinery assures continuous production at low operating and maintenance costs.

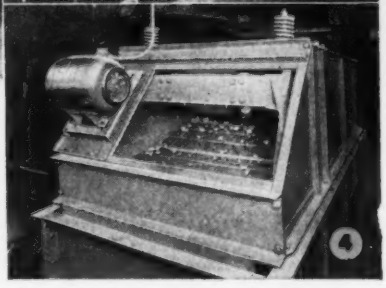
Here is mining machinery that is used by the world's leading producers of ores and industrial minerals.

Write for complete information.









1 GRINDING MILLS . . . Ball, pebble, tube, rod and compartment types for wet or dry, open or closed circuit operation. Sizes to 13' diameter and up to 50' long.

2 MINE HOISTS . . . Built in conventional drum types as well as in friction types, for hoisting both ore and men, in a wide range of sizes to meet large coal and metal mining operations.

3 NORDBERG ENGINES . . . From small power-units to large stationary plants, for Diesel, Duafuel®, and Spark-Ignition Gas operation, in sizes to over 11,000 horsepower.

4 VIBRATING SCREENS and GRIZZLIES . . . In types and sizes to meet practically all requirements from heavy scalping to fine screening applications.

NORDBERG MFG. CO., Milwaukee 1, Wisconsin

NORDBERG

SYMONS . . . a registered Nordberg trademark known throughout the world.

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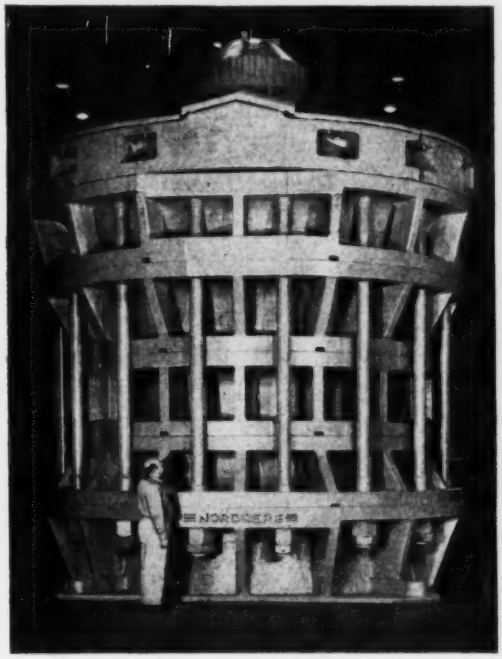
SYMONS CONE CRUSHERS

Built in 11 different sizes, ranging from 22" to 7' dia., for capacities from 6 to 900 or more tons per hour.

(Illustrated at the right is a typical installation of Symons Cone Crushers and Rod Deck Screens serving a large Taconite Iron Ore producer).



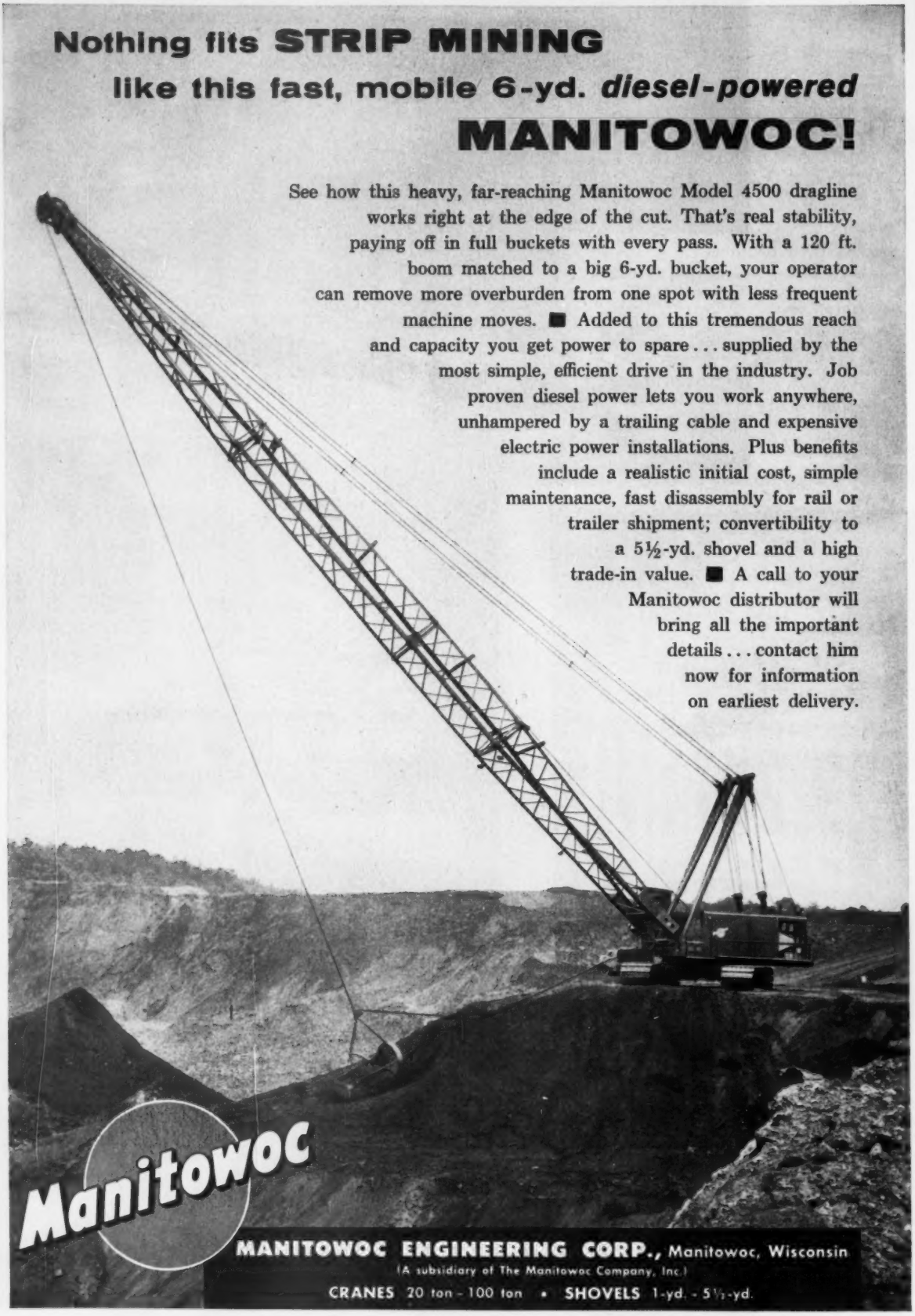
SYMONS GYRATORY CRUSHERS

For heavy-duty primary breaking, available with feed opening sizes of 30", 42", 48", 54", 60" and 72", for capacities to 3,500 and more tons per hour.

©1958, N. M. Co.

M158

Nothing fits **STRIP MINING**
like this fast, mobile 6-yd. *diesel-powered*
MANITOWOC!



See how this heavy, far-reaching Manitowoc Model 4500 dragline works right at the edge of the cut. That's real stability, paying off in full buckets with every pass. With a 120 ft. boom matched to a big 6-yd. bucket, your operator can remove more overburden from one spot with less frequent machine moves. ■ Added to this tremendous reach and capacity you get power to spare . . . supplied by the most simple, efficient drive in the industry. Job proven diesel power lets you work anywhere, unhampered by a trailing cable and expensive electric power installations. Plus benefits include a realistic initial cost, simple maintenance, fast disassembly for rail or trailer shipment; convertibility to a 5½-yd. shovel and a high trade-in value. ■ A call to your Manitowoc distributor will bring all the important details . . . contact him now for information on earliest delivery.

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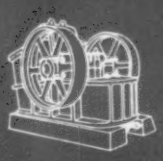
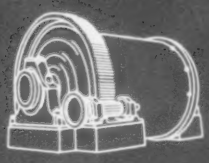
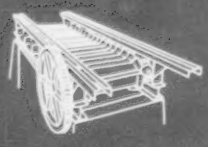
MANITOWOC ENGINEERING CORP., Manitowoc, Wisconsin
(A subsidiary of The Manitowoc Company, Inc.)
CRANES 20 ton - 100 ton • SHOVELS ½-yd. - 5½-yd.







Traylor

Traylor-MADE

TRAYLOR . . . a name known to the mining industry throughout the world for producing machinery designed to deliver maximum production at the least possible operating cost year in and year out. For over half a century Traylor machines have been in daily use by hundreds of operators, demonstrating time and again Traylor engineers build the very best in mining machinery.

TRAYLOR ENGINEERING & MANUFACTURING COMPANY

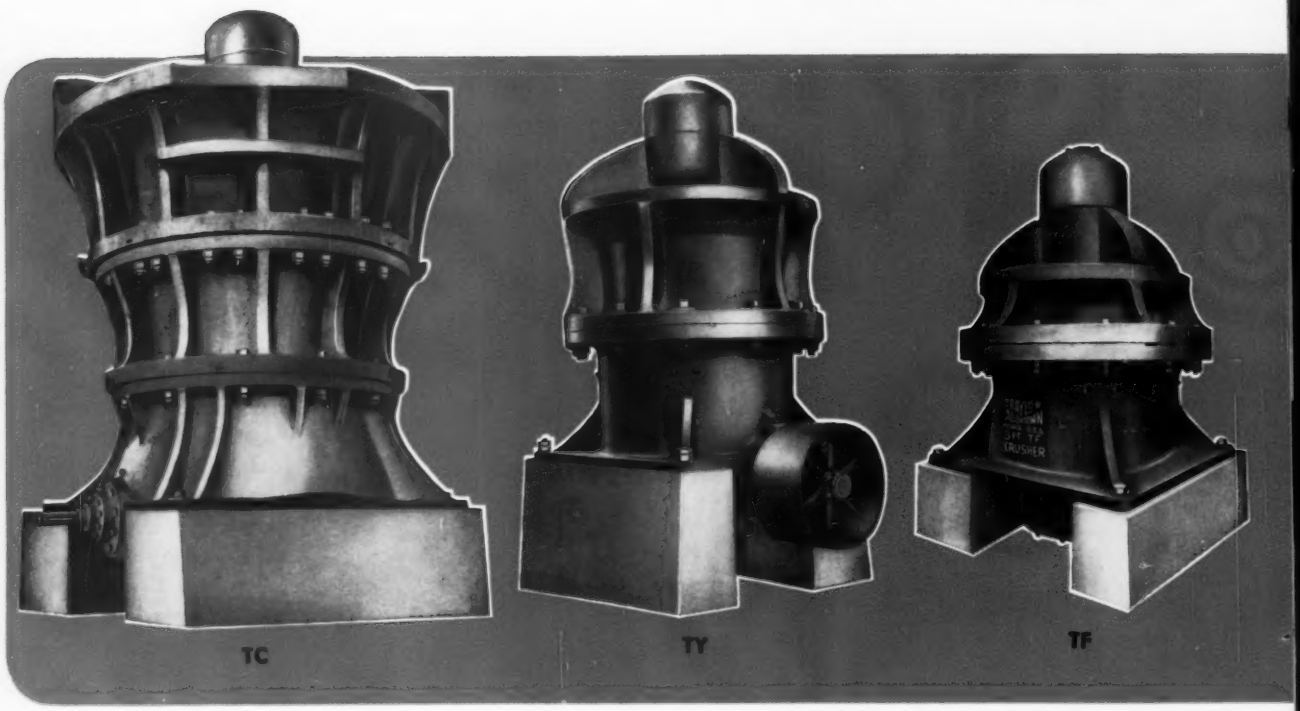
ALLENTOWN, PENNA., U.S.A.

Traylor MADE

CRUSHING

offers the operating TRAYLOR CURVED

An original



PRIMARY Crushers

Traylor Bulldog Gyratory Crusher Type TC is the most advanced design of large capacity gyratory crushers. Built in six sizes with capacities ranging from 245 tons of a 2″ product to 4100 tons of an 11″ product, these gyratories feature Traylor original non-choking, self-tightening bell head and curved concaves. Massive construction provides for shock absorption and at the same time all parts are readily accessible for maintenance. The Traylor patented dust seal provides a practical and efficient device for excluding dirt from the lubrication chamber. These are just a few of the features of the Traylor TC Gyratory Crusher—features you want in your crushing machinery.

SECONDARY Crushers

Traylor makes two types of reduction crushers: the TY in six sizes from 1′-3″ to 5′-6″ with feed openings from 3″ to 22″, and the TF Fine Reduction Crusher for operators whose needs demand economic production of 5/16″ to 1-1/4″ material in large capacity. Both of these crushers require less head room due to compact, simplified design. Traylor original curved concaves and self-tightening bell head are used in the TY and TF Crushers. The design, construction and operational features embodied in these reduction crushers are the direct result of Traylor's long and diversified experience and leadership in the ore and stone crushing field.

Traylor

NEW YORK: 3416 Empire State Bldg. CHICAGO: 1213 Fisher Bldg. 343 S. Dearborn St.

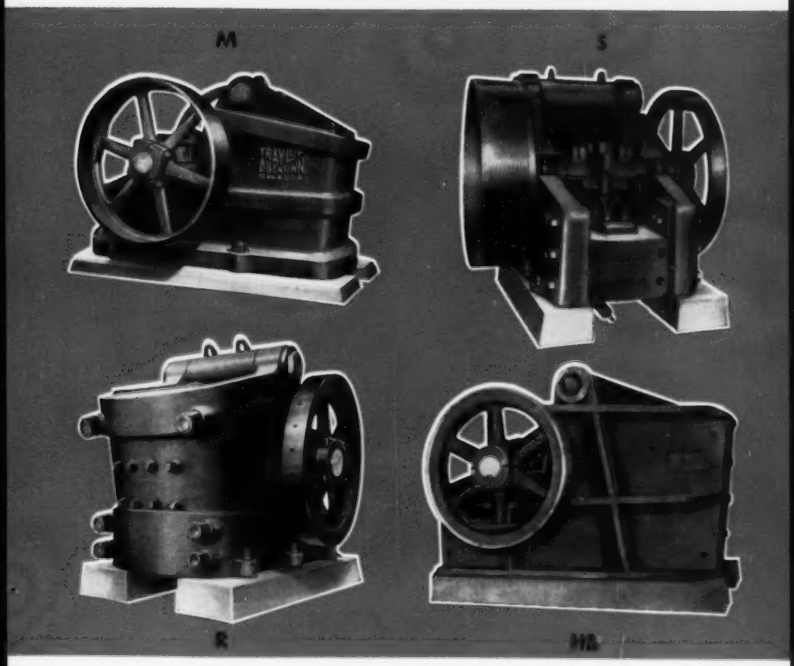
SAN FRANCISCO: 605 Sharon Bldg. 35 New Montgomery St.

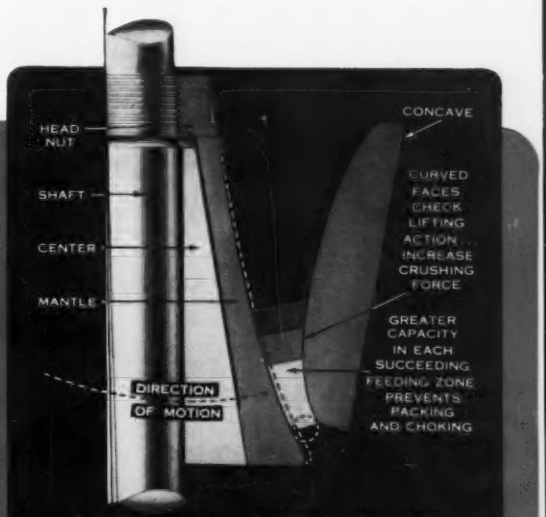
FOREIGN SALES AGENCIES: Lima, Rio de Janeiro, Buenos Aires, Santiago, Antofagasta, Oruro,

MACHINERY

efficiency and economy of CRUSHING SURFACES . . .

Traylor development





Curved crushing surfaces, an original Traylor development, are shaped so that the faces are opposed to the direction of motion. Power requirements are reduced, even at finer settings, because more of the power applied is used as a direct crushing force.

By increasing the capacity of each succeeding feeding zone in the crushing chamber, choking and packing are practically eliminated.

JAW Crushers

As a result of Traylor's many years of experience in building crushers, they have developed one of the most advanced groups of jaw crushers made. Traylor Jaw Crushers are built in five types with 18 different size feed openings. Capacities range from four tons of 7/8″ material to 1,000 tons of 11″ material per hour. The five types of Traylor Jaw Crushers are H, HB, M, R and S. All of these five machines are precision built to perform their rugged task efficiently.

Traylor's patented swing jaw suspension and originally developed curved jaw plates account for greater capacity at finer settings and longer life of jaw plates. Traylor's curved jaw plates will outwear ordinary plates as much as 3 to 1. All frames are reinforced at critical points to provide strength without excessive weight. For more information on Traylor-Made Jaw Crushers, state your requirements and a bulletin will be forwarded to you immediately.

AUSTRALIAN MANUFACTURER: Jaques Bros. Richmond S-1, Victoria, Australia

CANADIAN MANUFACTURER: Canadian Vickers, Ltd. P.O. Box 550, Place D'Armes Station, Montreal, P.Q. Canada.

La Paz, Montevideo, S. A.; Madrid, Spain; Oslo, Norway; San Juan, Puerto Rico; Manila, P. I.; London England.

Other fine Traylor-Made Products in use by the mining industries throughout the world.

TRAYLOR CRUSHING ROLLS are built in three types—the Four Tension Rod type capable of delivering large capacities and standing up under the most severe, continuous service. Type AA and A Rolls are designed for lighter service. The range in size of the three rolls is from 18″ dia. x 10″ face to 78″ dia. x 24″ face with tension springs to develop pressures up to 30,000 lbs. per lineal inch of roll face. Write for bulletin #6637.

TRAYLOR CASTING MACHINES are built in two types: Circular and Straight Line. The Circular Casting Machine is heavily proportioned, driven by two motors through separate gear trains but with a single control and is designed to run in either direction. The track is conical, and the turn-table supporting the mold platform runs on flanged conical rollers. Traylor Casting Machines have been built in sizes up to 40′-0″ and can be designed for anode, cathode, wire bar or pigs. Write for additional information.

TRAYLOR MANUFACTURES four types of feeders specially designed for application in the several steps of crushing, grinding, drying or calcining. These four types are the Sheridan Grizzley Feeder, the Apron or Pan Feeder, the Table Feeder and the Slurry Feeder. Grizzley Feeders are made in sizes from 3′-0″ x 6′-0″ to 10′-0″ x 20′-0″ and Apron Feeders in widths of 30″ to 84″ in any length required. All Traylor Feeders are adapted to the size and kind of material to be handled and are easily adjusted to vary their rate of delivery of material. For more on Traylor Feeders, write for bulletin #2114.

TRAYLOR ENGINEERS have pioneered and developed some of the outstanding features used in kiln manufacture. One of the improvements made by Traylor engineers is the design and perfection of the easy aligning, single roller supports used on Traylor Rotary Kilns, Coolers, Dryers and Slakers. The "full-floating" type of tire is another Traylor Kiln advancement. For details on Traylor Kilns, Coolers, Dryers and Slakers, write for bulletin #1115.

Traylor

TRAYLOR ENGINEERING & MFG. CO., 1014 MILL ST., ALLENTOWN, PA.

Sales Offices: New York — Chicago — San Francisco

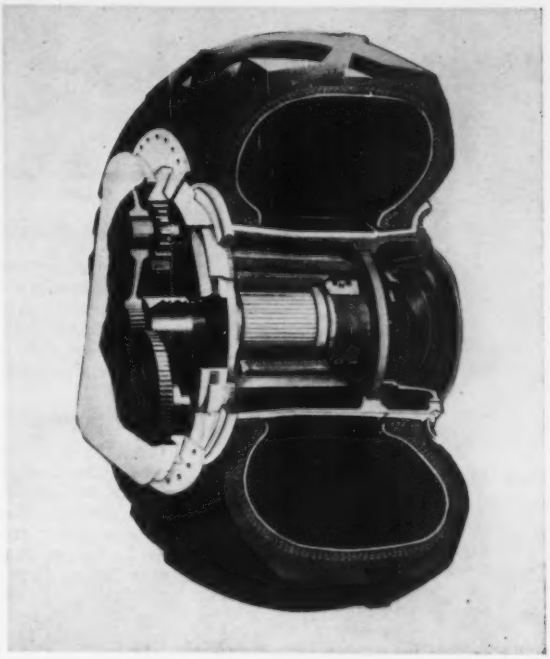
Canadian Mfr.: Canadian Vickers, Ltd., Montreal, P. Q.

E&MJ NEW PRODUCTS DIGEST

In this issue—G.E.'s electric wheel that will fit your present earthmover, a large truck from France, rubber hose in almost any length, a flanged conveyor belting, custom tandemized mine locomotives, a fire-proof hydraulic fluid, a silicon carbide foamed refractory that withstands 4,000 deg F, and many other new products and choice literature notices in this special eight-page New Products Digest section of the June *E&MJ* Mining Guidebook issue.

For more information about these items, circle the proper number on the readers' reply card opposite page 56, give your name and address, and mail (with proper postage) to *E&MJ*.

If you're getting this copy of *E&MJ* second-hand and would like your own personal copy, simply mark the convenient subscription order block at the bottom of the readers' reply card, and mail it to *E&MJ* with the proper postage.



General Electric's Motorized Electric Wheel Fits Present Earthmovers (1)

UNMATCHED versatility of earthmovers for open pit mining is now possible with the motorized wheel redesigned by General Electric Co. Motorized wheel was originally designed by G.E. to power Admiral Byrd's famous Antarctic Snowmobile in 1939 and has been adapted so that it now fits easily onto the frame of any earthmover. According to F. H. Craton, manager of G.E.'s Locomotive & Car Equipment Dept., more maintenance-free working days are possible due to the ability of the motorized wheel to match conditions at each wheel.

Motorized wheels eliminate transmissions, axles and gear shifts by including the electric traction motor as an integral load-carrying part of each wheel. All-wheel drive is provided by either a trolley wire or an engine-generator mounted on the earthmover. Mr. Craton says that earthmovers fitted with electric wheels can carry twice the payload of conventional designs.

Dynamic braking is another feature of the electric wheel—it is possible to stop a huge vehicle doing 35 mph in about three vehicle lengths. The wheel illustrated above has a 45-in. dia rim on which large tubeless tires can be mounted. The traction-motor develops 380 rim horsepower, and four such wheels will propel a 125-ton vehicle at up to 35 mph.

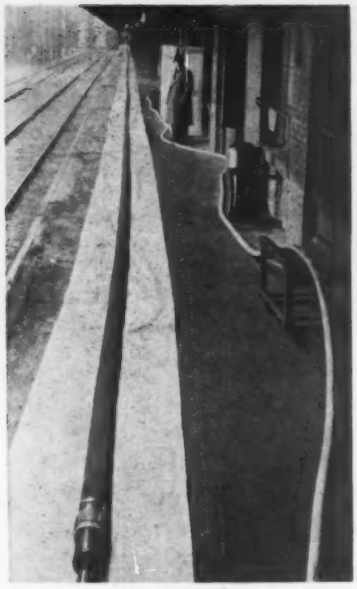
Berliet's Truck Can Carry 100-Ton Payload

THE PROBLEM of supplying equipment to a drilling crew in the Sahara Desert was solved by Automobiles M. Berliet's T-100 off-the-road monster that requires six 8-ft dia Goodyear Tire & Rubber Co. tires. The bearing surface of all six wheels comes to 100 sq ft, which in the case of the 100-ton load results in a pressure of only 14 psi on the ground.

The truck is 16 ft wide, 13 ft tall and 41 ft long. It was displayed at the International Petroleum Exposition at Tulsa, Okla, in April. Truck's top speed is 28 mph.

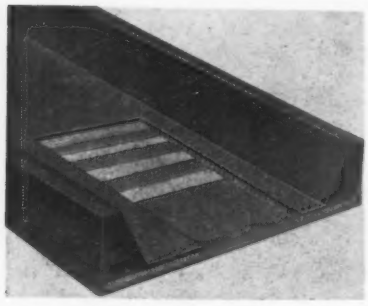
Power steering, power brakes and power-assisted gear shift with eight speeds forward and eight reverse ease the work of handling the truck. The engine is a 600-hp turbo-diesel. And according to Berliet, the cab is a driver's heaven—filtered, conditioned air; five-abreast seating; two sleeping compartments; instrument panel; cooking range and drinking tank.

The T-100 was tested on a large and extremely rough terrain, replete with obstacles such as deep trenches, quagmires, steep inclines, camel-backs and sand, and came through with flying colors. In the field of large haulers, E&MJ notes that several manufacturers in the U.S. are considering the demand for large—80 to 100 ton—side and bottom dump rubber-tired units for trackless open pit mining.



New Hose Process (3)

A new, continuous production process has been developed by Goodyear Tire & Rubber Co. to build large diameter hose without splices in lengths limited only by the size of the transportation available—hose above is 500 ft long of 4-in. dia. The hose can be manufactured to float or sink for marine use and can handle all known chemicals and fuels. Sizes between 2- and 8-in. dia. are available.

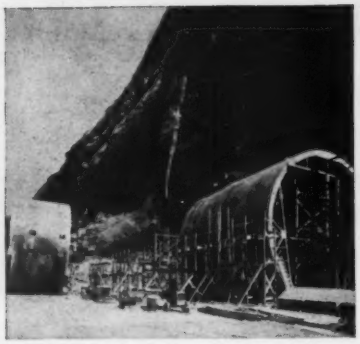


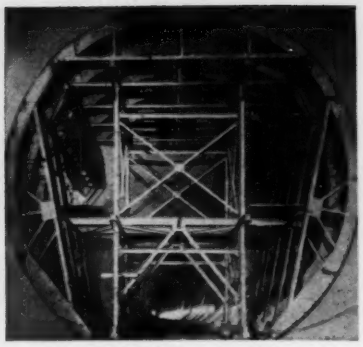
Flanged Conveyor Belt (4)

A patented flanged edge conveyor belting, which eliminates the use of troughing idlers, is now available from Mono-Belting Corp. Belting is pre-tensioned to flex as it passes around the pulleys, eliminating fatigue due to flexing and allowing belt speeds much higher than those possible with troughed belts, according to the manufacturer. Belting is available in every grade, type and class of belting previously used in the industry in widths up to 48 in.

Chicago Pneumatic Buys Reich Bros. Drilling Line

The Reich line of truck and crawler-mounted drills, rigs, etc. has been purchased by Chicago Pneumatic Tool Co. For further details on Reich Brothers Mfg. Co., Inc. rotary and down-the-hole rigs see NPD, November 1959, p 44.



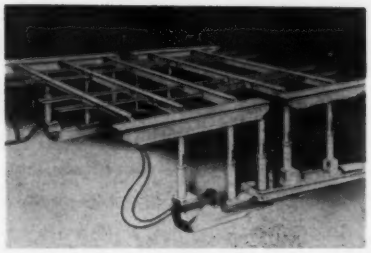


Non-Telescopic Form Sections Speed Tunnel Construction (5)

Form setting time and costs have been reduced in the construction of 6,000 ft of diversion and spillway tunnels at the Glen Canyon dam, Page, Ariz., through the use of all-steel non-telescopic forms that are highly mobile and accurate. At the present time, two 60-ft sections with 41-ft "A" line are in use. The forms were made by Blaw-Knox Co. Photo at left above shows forms being assembled outside the tunnel. At right, the form can be seen in the diversion tunnel.

Roof Support Systems (6)

At the May American Mining Congress, Cleveland, Ohio, Coal Show, the Dowty Mining Equipment Ltd. showed their complete line of roof support systems including recently developed automatic hydraulic units which the firm says "offers large economies by eliminating the manhandling of supports and greater safety against roof falls." In the past ten years Dowty has supplied more than one and one-half million hydraulic pit posts to the world's coal miners. Photo opposite is of the self-advancing Canopy for room-and-pillar mining. Also



available are the Roofmaster for long-walling and the Rodjo for fresh face headings.

Mine Power Center (7)

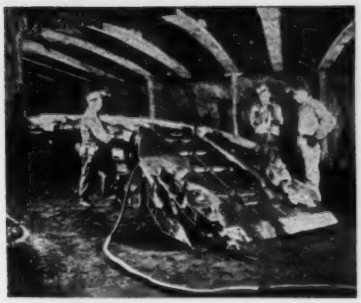
A special low-height power center built by Westinghouse Electric Corp. is said to be the world's highest-rated dry-type mine power center. Unit is installed in an eastern U.S. coal mine and is of 600 kva design, reducing 7200 v to 480 v through delta-connected primary and "Y" connected secondary. The ASL dry-type core and coil assembly are totally enclosed in a pressure-tight nitrogen-filled compartment. A power distribution panelboard with four molded-case breakers provides built-in thermal overload

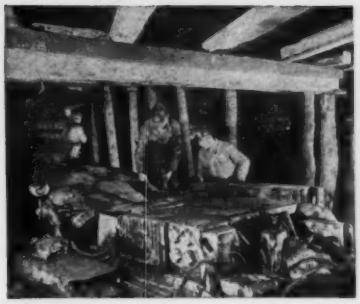
and instantaneous short-circuit protection for the low voltage section.

Fire-Resistant Hydraulic Fluid Developed By Shell Oil (8)

A virtual end to serious worker injury and costly property damage resulting from hydraulic fluid oil fires in mines is claimed for the world's first economical fire-resistant fluid being introduced by Shell Oil Co. Hydraulic oil is 3XF Mine Fluid—a water-in-oil emulsion with a built-in fire extinguisher that smothers fires before they can get started. Shell says that the U.S. Bureau of Mines has evaluated 3XF and acceptance is pending. Oil is furnished with emulsifier added and the mine maintenance crew need only add the water to prepare the fluid for use. Photo shows fluid being sprayed through an open flame from a cutting torch to demonstrate the flame resistance of the new fluid. Upon exposure

to open flame, high voltage arcs or hot metal, the water in the fluid is released to quench combustion.





Mining Machine Lubricant Improves Unit Performance in Tests (9)

When a new mining lubricant was demonstrated in a continuous coal miner, a significant increase in the amount of coal loaded between machine overhauls was noted. At a large W. Va. mine, where an eight-month field test was recently concluded by Gulf Oil Corp. field engineers, the new lubricant—Gulf Mining Lubricant H.D.—also simplified the lubrication of other face equipment, including shuttle cars, loaders and cutting machines. Lubricant H.D. contains an organic additive, which is water-resistant and body-building and which provides controlled leakage of the base oil to flush dirt out of working parts.

Safety Hats and Caps (10)

An entirely new line of fiber-glass, aluminum and electrical (plastic) safety hats and caps has been developed by Apex Safety Products and will be marketed nationally by Boyer-Campbell, safety equipment distributor. Both firms are divisions of White Sewing Machine Corp. Headgear has a polyethylene suspension which includes lock-straps at the peak to insure 1¼-in. crown clearance. Another feature is a plastic-zippered leather or leatherette sweatband that can be replaced quickly without disturbing the suspension. One hat or cap is provided to accommodate all head sizes from 6⅝ to 8. Fiber-glass construction is made of flame-retardant resin and is entirely free of metal parts. Aluminum line also is free of metal, except the shell.

Foamed Silicon Carbide (11)

Silicon carbide foam, a lightweight corrosion-resistant material with high porosity and thermal insulation up to 4,000 deg F, is now in pilot plant production at Carborundum Co.'s Niagara Falls research center. Easily machined with standard steel cutting tools, the new refractory material can be fabricated into complex shapes at close tolerances. Cubic foot of Silicone Carbide Foam weighs only 16 to 18 lb. Thermal conductivity is 5 Btu/in./ft²/hr/deg F at 800 deg F for the low density form. Material is being produced in sizes up to 13x20 in. and more information can be had from Carborundum Co.

Sinker Drill (15)

A heavy-duty sinker combining the Beavertail retainer with an all-new front assembly has been developed by Chicago Pneumatic. Retainer replaces spring cushions with a compressible rubber cushion that presses into place. CP-69 is designed for either lateral or overhead airleg operation as well as downholing.

Rope Thread Bits (16)

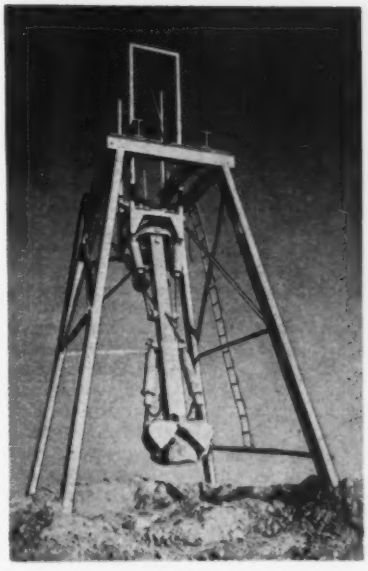
Brunner & Lay, Inc. now offers a line of rope thread carbide Rok-Bits, Carbo-Rok sectional rods, couplings and striking bars. Rok-Bits come in 2½-, 2¾-, 3-, 3½- and 4-in. sizes with 1½-in. rope thread. Bits in 3-, 3½- and 4-in. size are available in 1¾-in. thread. In the 2-in. thread, bits come in 4-, 4½- and 5-in. size.

Heat Reflecting Glass (13)

A plate glass heat shield which reflects 65% of the long wave infrared has been developed by Corning Glass Works and is being offered to industry under the Pyrex brand. The window of tempered Pyrex glass is covered with a thin transparent metallic film that literally bounces heat off the glass. The glass itself does not become hot. Shields are available in three standard sizes—24x24, 24x36, and 24x28 in., or can be had in any specific size.

Nailer For Air Hammer (12)

A line of nailing attachments for its line of air hammers has been announced by Superior Pneumatic & Mfg., Inc. The Superior H.D. nailer is designed for use with the manufacturers heavy duty Bantam Bully hammer and handles 8 to 60 penny nails, and 8-, 10- and 12-in. spikes. The nailer will drive a 16 penny nail into oak in 2.8 sec.

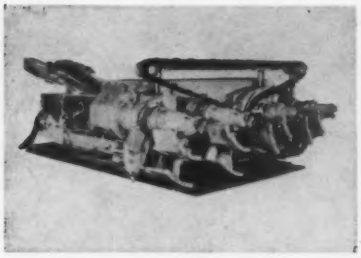


Inclined Shaft Mucker (14)

Shaft & Development Machines, Inc. earlier in the year announced a new inclined shaft mucker—a small compact unit designed to perform in limited openings. The machine runs on skids or rails on the incline with support provided to prevent bumping the cage against the shaft walls. One operator controls the entire mucking cycle through the air cylinders that power the machine.

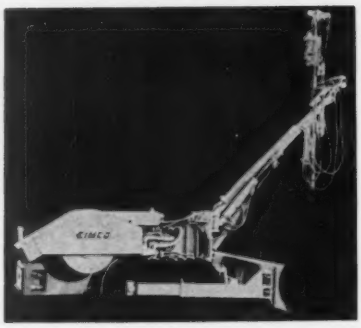
Long Conveyor Belt (19)

Eleven miles of rubber belting, carrying 1,000 tph for 5½ miles from mine to mill, will soon be in operation at Ideal Cement Co.'s Ada, Okla. operation. One section of the system will have 4½ miles of belt to cover a 2¼ mile span of conveyor—world's longest at the present time, according to B. F. Goodrich.



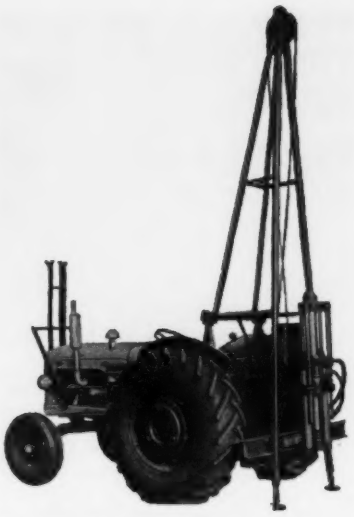
Continuous Miner (65)

A continuous boring miner machine, with a mining height that can be varied from 48 to 66 in. while operating, is now available from Goodman Mfg. Co. Designated Type 300, the machine can be used in both development and production work. At 48-in. height it cuts an arch-sided path 13 ft 10 in. wide; at 66 in., the path is 14 ft 10 in. At any height the machine leaves a 12-ft wide flat bottom. One 250 hp ac or dc totally enclosed explosion-proof motor powers all moving parts.



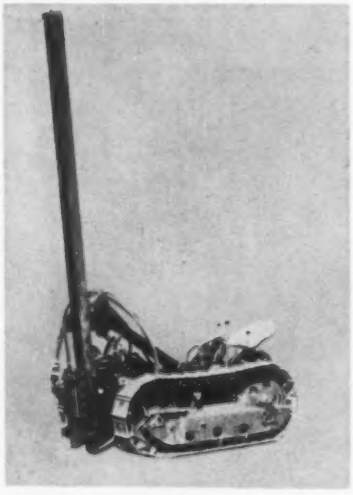
Electric Dozer-Bolter (18)

Eimco Corp. is producing an electric dozer and mine roof bolter, designated Eimco Model 637. Shown here with the hydraulically operated roof bolter attachment, the dozer operates on ac or dc motors, which drive the pumps, providing hydraulic power to independently activate the moving parts. The boom permits 50 deg lateral movement and folds back to less than 5 ft headroom.



Tractor-Mounted Drill (21)

Tractor-mounting is a special application of Sprague & Henwood, Inc. 40-C and 40-CL core drill machines. The machine can be attached to any tractor when needed. Here it may be seen mounted on a Fordson tractor, equipped with a size NW oil-operated hydraulic swivelhead, four pole derrick and built-in water pump for clear or recirculated water. Normally the 40-C and 40-CL are skid-, trailer- or truck-mounted.

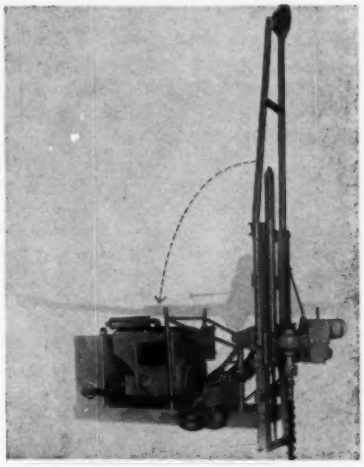


Crawler Drill Jumbo (66)

Machinery Center, Inc. has introduced a versatile crawler-drill-jumbo combination. The jumbo can be mounted with one or two jibs for single or multiple hole drilling. A wide selection of tools from jack hammers to 4¼-in. bore units can be had. Motor is a reversible 15 hp piston-type air motor through a three speed tractor transmission.

Three Rotary Drills (67)

Three new and improved models of Type 8 rotary drill are available from Davey Compressor Co. Model M-8A is a rotary blast unit for mounting on any standard truck. It has rated capacity in excess of 1500 ft using 2⅞-in. API drill pipe. Model M-8A is similar, but is equipped with a special long kelly and mast. It can drill 24-ft ledges without changing steel. Model M-8MA is a combination air blast and mud rotary rig. Change from mud to air blast drilling is accomplished by shut-off and by-pass valves. Rated capacity with air blast and 6-in. bit is 600 ft in fair to good sediments. With mud, capacity is over 1,000 ft using 9-in. bits. Maximum hole size is 20-in. dia.



Exploration Drill (22)

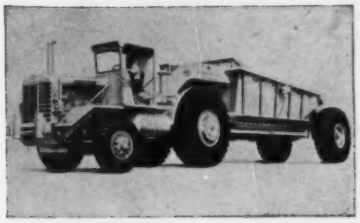
Mobile drilling, Inc. B-40 Explorer is designed to do augering, coring and large diameter earth boring. Continuous flight augering to 75 ft, coring to 500 ft and boring of holes 24-in. dia are possible. B-40 is self-powered by a 4-cylinder 36-hp air-cooled engine. It is available without engine for mounting on any PTO-equipped truck, barge or tractor. Both the tower and the drill frame lower to the horizontal. Drilling speeds range from 62 to 500 rpm with maximum torque output of 1740 ft lb. Centralized controls permit one-man operation. For more details and literature, check this number on the card.

Continuous Miner Bit (17)

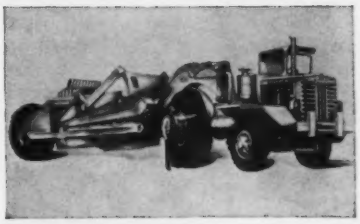
Type AP-10R cutter bit from Austin Powder Co. is available in 15 or 7½-deg rake angles in 1½- or 1¾-in. shank.

Six Way Drill (20)

Houston Tool Co.'s Hi-Vac injection drill Model H.D. 250 will remove cuttings from the drilled hole in six different ways and will drill in any direction in any kind of formation according to the company. Methods by which cuttings can be removed are—vacuum (2⅜ in. hole to 150 ft), reverse water (to 150 ft), forced water or mud (to 250 ft), vacuum diamond core (permits driller to view core while still in the hole), drive coring (takes 2-in. undisturbed drive core for compacting test) and augering up to 6-in. dia. (2½ in. to 100 ft).



MODEL 496 Payloader has 27-cubic yd struck capacity. Check item. **(23)**



MODEL 495 Payscraper has 24-cubic yd struck capacity. Check item. **(24)**

MODEL 295 Payscraper has 24-cubic yd struck capacity. Check item. **(25)**

International Harvester Introduces Many New Earthmovers For the Mining Industry

Three of International Harvester Co.'s new machines are shown above as Item No. 23 (Model 495 Paywagon with 27-cubic yd struck and 40.5-cubic yd heaped capacity, Item No. 24 (Model 495 Payscraper with 24-cubic yd struck and 31-cubic yd heaped capacity), and Item No. 25 (Model 295 Payscraper with 24-cubic yd struck and 31-cubic yd heaped capacity).

Item No. 26 is Model 95 rear dump Payhauler with heated body of 18-cubic yd struck capacity. Engine is International's 817 turbocharge diesel. Model 65 rear dump Payloader (Item No. 27) has naturally-aspirated D-817 diesel engine and a struck capacity of 12.5-cubic yd.

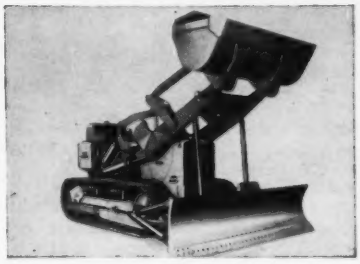
The International Pippin No. 260 backhoe (Item No. 28) is designed to work in tight quarters, has a digging radius of 180 deg, 12½ ft digging depth and 14¾ ft reach. The International 660 wheeled tractor has an estimated 75 horsepower at the belt and 68 at the drawbar. It is built to work with a ¾-cubic yd International Wagner front-end loader and can be equipped with backhoe.

MODEL 95 Payhauler has 27-ton payload. Check item for further details. **(26)**

MODEL 65 Payhauler has 19-ton payload. Check item for further details. **(27)**

BACKHOE No. 260 can dig forward to within 6 in. beneath its axles. Item. **(28)**

WHEELED tractor 660 is ideal for pulling 4-wheel scrapers. Check item. **(29)**



ANGLING dozer No. 977A is available for No. 977 Series E Traxcavator. **(30)**

SERIES F No. 933 Traxcavator has been introduced by Caterpillar. **(31)**

TRACTOR D7 develops 140 flywheel horsepower (112 at drawbar). **(32)**

Caterpillar Tractor Announces Five More Machines

For more information about the Caterpillar Tractor Co. products displayed here, check the appropriate number in each individual caption. Item No. 30—an angling bulldozer is now available for No. 977 Series E Traxcavator. Item No. 31—a No. 933 Series F Traxcavator has rated 52hp. Item No. 32—D7 Series D tractor is turbocharged and has 112 drawbar hp. Item No. 33—a No. 619 wheeled tractor and No. 442 scraper combination. Item No. 34—a Series C 29 cubic yd heaped capacity.

WHEELED tractor No. 619 and No. 442 scraper combination announced. **(33)**

SERIES C No. 463 scraper is designed to operate with D8 or D9 Cat. **(34)**

USBM Approval for Getman

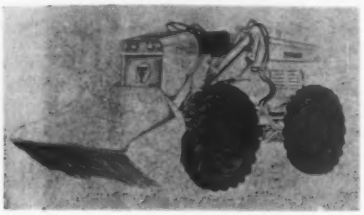
The Getman Brothers ore carriers—Model D52, D70 and KD2—have received U.S. Bureau of Mines approval for underground use. Getman uses the Deutz Model FIL 612 engine (10hp) in the vehicles.

Turbocharged Tournapull (35)

Model B Tournapull—a 360hp unit—has been announced by LeTourneau-Westinghouse Co. Engine is a GM Diesel turbocharged, six-cylinder, two-cycle diesel and is available with Allison torque-converter or a newly offered step-gear transmission. Model B is already available with a 335hp engine.

Wheeled Loader (36)

Model 210 wheeled loader by J. I. Case Co. can lift its half-ton bucketful to 10 ft 5 in. It dumps at 45 deg angle, has 30-in. reach and 8-ft 5-in. clearance. Engine is a 4-cylinder 34-hp unit developing 106 ft lb at maximum torque. Bucket sizes are 11-, 13- and 18-cubic ft. Model 210 can be equipped for digging, trenching or loading. As a backhoe, the unit can dig to 10 ft.

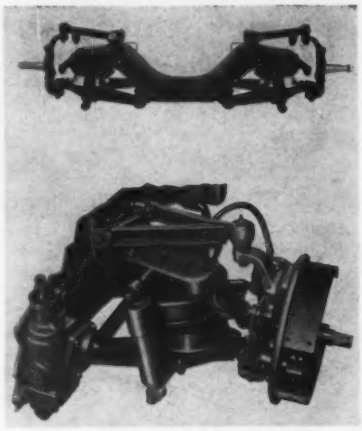


Wheeled Loader (37)

Six bucket sizes—from 1- to 3-cubic yd—are available for the new TL-14 Tractoloader just now coming on the market from Tractomotive Corp. Maximum dumping clearance under the hinge pin is 10 ft 5 in. Engine is either an 86-hp 6-cylinder Allis-Chalmers gasoline or an 81.5-hp diesel. Literature offers handy chart for selecting proper bucket size based on weight of material to be handled.

Wheeled Tractor Loader (39)

The Frank G. Hough Co. has recently announced the addition of a Model H-120 rubber-tired, four-wheel drive tractor shovel to the Payloader line. Model H-120, according to the manufacturer, has the highest dumping clearance (14 ft 7½ in. to the center of the hinge pin), longest reach (3½ ft ahead of the front tire), and most powerful engine of any tractor shovel of its size and capacity (300 hp at 2,100 rpm).



Independent Front Suspension For GMC 8000 Series Trucks (38)

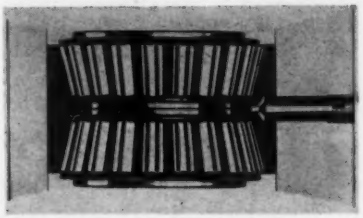
Independent front end suspension—something new in the trucking industry—is available on General Motors Corp. Truck & Coach Div.'s Series 8000 trucks. Above may be seen the front view showing the front crossmember, control arms, steering knuckle and bump stops. Below it, in the same photo, may be seen the newly developed air suspension bellows in close detail. GMC engineers say that the method's advantages are stability, comfort and better road feel for the driver.

Thew Shovel Announces a Wheeled Front End Loader (40)

For the first time in the history of the Thew Shovel Co., a product other than a power shovel or crane will bear the trade name Lorain—a Model ML-156 Moto-Loader with 2-cubic yd bucket, 4-wheel drive and 105-hp 6-cylinder gasoline engine. Planetary wheel drive, power assist steering, torque converter and fully automatic transmission are among the many features of the Moto-Loader.

Magnetorque Tranmission For Excavators (41)

For shovel operators familiar with tough digging, the Harnischfeger Corp.'s P&H magnetorque power transmission method means faster and easier excavating. High speed slams of the dipper into the bank to dislodge material are no longer required. Frequent dipper stalls are eliminated.



Double Cup Bearings (42)

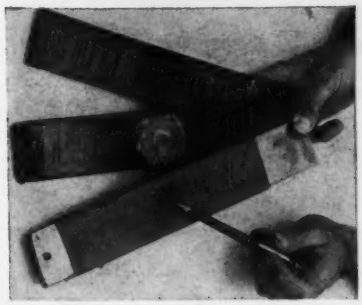
Timken Roller Bearing Co. has introduced a line of Pin-type double cup bearings which have a distinct advantage over conventional double cup designs on jobs where there is a tendency for the outer race or cup to creep or turn in the housing. Hollow pin in the housing fits into the cup and prevents the pin from turning, but does not restrict axial float.

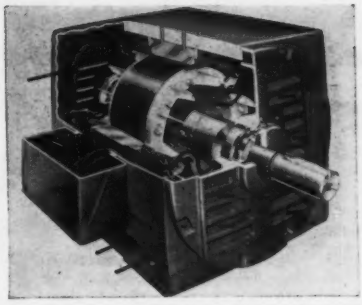
Complete Static Protective Relay For Switchgear (43)

Allis-Chalmers Mfg. Co. plans to manufacture a line of transistorized static protective relays which are the first major departure from the mechanical induction disc design introduced 50 years ago. Static relay is ⅓ the size of its predecessors. Three single-phase units fit present switchgear and panelboard cutouts designed for one single-phase induction type. Calibrations and setting are adjusted with three sets of external controls located at the front of each relay circuit.

Dredging Agitator (68)

Van Gorp Mfg. Inc. has announced a medium weight dredging agitator designed to increase production through double edged teeth, "Aggretator" face, and side plates that push rock away from the nozzle and keep them out of the pump line.



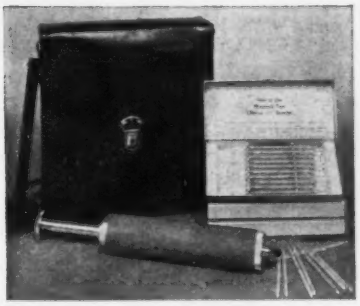


General Electric's New Insulation and Motor Designs (44)

Industry's first line of random-wound motors with a sealed silicone Polyseal insulation system are available from General Electric Co. With the Polyseal compound, the motor windings are so completely sealed that drip-proof motors may be used on many applications in wet or corrosive areas. In many areas, open motors can be used where totally enclosed were required formerly. Polyseal is flexible, does not crack or break loose from electrical parts. GE warns that the new design is not a cure-all—that in certain hazardous fume or abusive atmospheres, totally enclosed explosion proof motors may still be required. Custom 8000 line of motors shown at right above is available in horsepower rating from 100 to 600. Square style offers better enclosure and saves floor space. Several insulation systems are available in the Custom 8000 lines including the Polyseal shown at left above. Three test specimens are shown which were sand-blasted for 20 minutes at 40 psi with No. 80 grit. Varnished cambric (top) and flake-mica insulation were cut through by the blasts, while the Polyseal (below) successfully withstood the abuse according to General Electric Co.

Compound Lever Wrench (46)

The Ridge Tool Co. says that pressure on the handle of the Ridgid compound leverage wrench shown above doubles that of regular, equal jaw-size pipe wrenches and has shorter handle for work in close quarters. Wrenches are available from 2- to 8-in. pipe in four sizes.



Gas and Vapor Detector (48)

The Union Industrial Equipment Corp.'s Kitagawa Unico Model No. 400 gas detector provides an accurate, on-the-spot means of determining the concentration on many toxic gases and vapors. Average percent error at 68 deg F is less than 5%.

Meter Surveys Noise (45)

Palm-sized noise survey meter to measure noise hazards has been engineered by Mine Safety Appliances Co. Unit weights 12 oz and is not much larger than an electric shaver. Unit is calibrated in the range of 75 to 140 decibels.

Balanced Air Compressor (47)

Atlas Copco is offering a compactly designed economically-operated air compressor that delivers 1,075 cubic ft of air per minute at 100 psi. Unit, the ER-6, weighs 6,600 lb and can be mounted as a stationary unit or on a skid-frame for semi-portable use. A number of different drives are available.

Plastic-Lined Fittings (49)

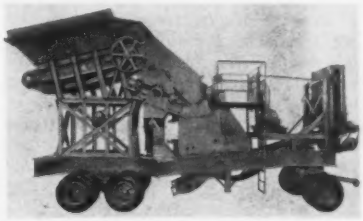
A complete assortment of Plastisol (PVC) lined pipe fittings in malleable iron or aluminum has been announced by Victaulic Co. of America. Fittings are supplied with grooved ends for quick-jointing pipe with Victaulic mechanical couplings. Sizes from 1¼ to 12-in. dia are available in a variety of fittings.

Hydraulic Jumbo (69)

Hydraulic jumbo arm with great flexibility, rapid positioning and accurate hole spacing features has been announced by Le Roi Div., Westinghouse Air Brake Co. The LJB jumbo is available in three lengths, with 4-ft telescopic extensions offered on two sizes. Sizes are 6-, 8- and 10-ft arm.

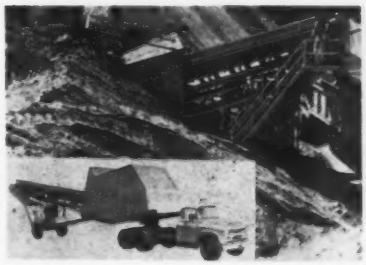
Corrosion Inhibitor (50)

The use of sodium molybdate as a corrosion inhibitor in recirculating systems may find widespread application for the first time as a result of a development by Climax Molybdenum Co. New applications involves sodium molybdate in combination with orthophosphate for commercial cooling applications.



Portable Crusher (51)

Latest addition to the line of portable crushing units by Straub Mfg. Co., Inc. is the Kue-Ken Portable Primary which includes an apron feeder, two-deck vibrating grizzly, Kue-Ken jaw crusher, conveyor and pushbutton controls all mounted on a trailer. Model above is electric; diesel-powered unit with side-mount generator can be furnished. Many sizes and capacity ranges are available.

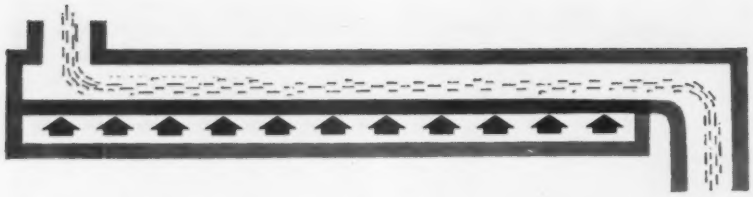


Portable Pitloader (52)

Koehring California says that the Ko-Cal 60-in. Pitloader portable unit can be set up in the field to load up to one cubic yd per second. Pitloader line also includes a 36- and 42-in. model.

Winkie Diamond Drill (70)

Bucyrus-Erie Co.'s Drill Div. has purchased the portable, lightweight Winkie drill which weighs 45 lb and is powered by a 5½ hp air-cooled gasoline motor. In shallow drilling the Winkie can recover cores up to 8-in. dia.

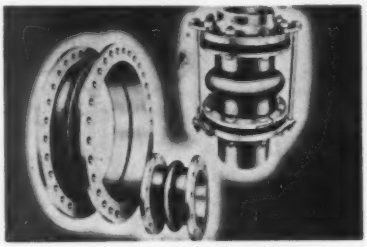


Kennedy Air Float Conveyor System Has No Moving Parts (53)

The Kennedy Van Saun Air Float conveyor is by no means a new product, having been on the market for many years, but so little about it has appeared in recent years, that we thought it time to remind you of it. AirFloat is based on a layer of porous ceramic plates through which air is blown, transporting and keeping in motion the solids within the sealed duct. It has no moving parts, nothing to wear out. It is compact, simple, rectangular in shape and mounts on a 6- to 10-deg slope. It requires less horsepower than any other system, according to the company. A single conveyor can handle hundreds of tons of feed per hour. For more details on the conveyor and the Kennedy automatic pneumatic conveyor pump, check Item No. 53 on the card opposite.

Expansion Pipe Joints (54)

Expansion joints for chemical, oil, water or exhaust steam lines, operating at temperatures from 180 to 200 deg F, are available from Raybestos-Manhattan, Inc. in sizes from ½ to 78 in. Designed for either pressure or vacuum, the joints offer protection from erosion, corrosion, vibration, expansion and contraction, and compensate for misalignment.



Anionic Surfactant (55)

Development of a surfactant with unusual anionic solution and stability properties for use in chemical reactions and detergent manufacture has been announced by Dow Chemical Co. Dowfax 2A1 is a sulphonated alkyldiphenyl oxide and is very soluble in water, acids and bases. It has good wetting, dispersing and emulsifying properties. Flotation reagent?

Speed Changers (56)

The Vari-Tex speed changer line in both horizontal and vertical units for smooth instant speed changes is now available from Allis-Chalmers Mfg. Co. An easy-to-read speed range indicator mounted adjacent to a hand wheel provides quick accurate speed indications. Four case sizes are planned by the company in speed ratio of 10:1 for 1-, 1½-, 2- and 3-hp units; 4:1 in the 40-, 50- and 60-hp units; and 6:1 in the intermediate range. Each of the units can be assembled to provide intermediate ratios of 5:1, 4:1, 3:1 and 2:1, using an 1800 or 1200 rpm standard squirrel cage motor.

Grinding Mill Stopper (57)

A patented stopping device for grinding mills that eliminates needless motor wear and tear is now available from Allis-Chalmers Mfg. Co. Unit is designed to stop the mill so that the manhole access is in the proper position. The device consists of a magnetic limit switch attached to a non-moving part of the mill and a magnetic operator installed on the revolving frame. No more trial and error, no more inching devices to get it right.

Dust Collector Cloth (58)

A non-woven synthetic felt cloth has been successfully tested to filter such abrasive dusts as taconite from the air, according to Troy Blanket Mills. Filter felt has high strength (up to 1,500 lb sq in. depending on fiber used), dimensional stability on continuous operation to 400 deg F, and is resistant to most acids and alkalies.

High Pressure Grease (59)

An extreme pressure, multi-purpose industrial grease with high melting point (500 deg F) has been developed by Standard Oil Co. of Calif. Available in three grades, Chevron Duraplex Grease-EP contains a new type of thickener, maintains high film strength, and is water-resistant, non-corrosive and non-toxic. It is suitable for semi- or fully-automatic lubrication systems. It will not harden or soften in storage.

Jig Hutch Control (60)

Automatic density discharge control for Jig hutch products and similar applications is provided by the Denver Equipment Co. Dowset valve. The valve, which is attached to the hutch, consists of a housing and a diaphragm valve. When sufficient solids have accumulated in the valve to displace the water pressure operating the valve, the valve opens and discharges at 70 to 80% solids. It can be used as an automatic sand bleed valve on all processing machinery where a sand or dense pulp must be discharged continuously or intermittently.

Tramp Iron Magnets (61)

Stearns Magnetic Products, says that the new three models of Indox V plate magnets are designed for installation on chutes, spouts, ducts and conveyors to remove tramp iron. Indox V is said to be superior to Alnico and other ceramic magnets — it is an oriented ceramic. The shape of the Indox V magnetic field prevents tramp iron from escaping as sometimes happens in weaker, unoriented designs.

Reinforced Plastic Pipe (62)

Bondstrand, the reinforced plastic pipe developed by Amercoat Corp., withstands the attack of acids, alkalies, and oxidized sulphides (and is impervious to their corrosion). Bondstrand can be used for air, water, in the mine or mill. A wide range of fittings in 2- to 8-in. dia sizes are available. Pipe comes in 20-ft lengths.

Portable Screen Plant (63)

Barber-Greene Model PS-70 portable screening plant screens while it loads and consists of a vibrating screen, portable belt conveyor, reciprocating feeder and hopper. Unit can be towed without disassembly. Check Item No. 63 for details and screening capacity data.

Speed Reducers (64)

A broad line of heavy-duty worm gear speed reducers is available from Philadelphia Gear Corp. in all ratios from 5 1/6:1; to 1212:1 with center distances from 3 to 21 in. with torque control in vertical or horizontal design.

For Your Files

This selected manufacturer's literature is free unless otherwise specified. If item is for sale, send request and money direct to manufacturer.

Exploration and Mining

BLASTING UNIT—the M-S-A 20-shot device complete with batteries—can be prepared to fire a shot in 15 sec. Bulletin (0901-4) from Mine Safety Appliances Co. describes the device in four pages *(109)*

FOUR CONCENTRIC layers of plastic insulate American Cyanamid Co.'s blasting cap wires for maximum performance according to a four-page bulletin (A-2050). *(110)*

EDISON MODEL S electric cap lamp available from Mine Safety Appliances Co. has been completely redesigned from lens to battery case. 4pp. *(111)*

WHEAT NATIONAL model electric cap lamp is presented in a four-page bulletin (593-5M) from National Mine Service Co. *(112)*

FIELD REPORT (No. 231) on the Sauerman dragline-crane in operation has been published by Sauerman Bros., Inc. 4pp. Also, the latest copy of SAUERMAN NEWS details slackline digging and haulage at an Ohio project. *(113)*

MINE RESCUE communication system provides positive party line communication between the rescue team and surface according to a two-page flyer (1608-1) from Mine Safety Appliances Co. **(71)**

COMPLETELY transistorized transmitter-receiver is a feature of Mine Safety Appliances Co.'s Model E-60 MinePhone (1601-11). 2p **(72)**

ELEVATORS, cages, hoist-conversion units designed by Connellsville Mfg. are set down in a four-page bulletin (200). **(73)**

SHAFT PRODUCTION equipment in the Connellsville Mfg. line is discussed in a four-page bulletin (100). *(114)*

RUBBER-TIRED cutting machines—Goodman Mfg. Co.'s 2400 Series—are detailed in a 12-page bulletin (G-138). **(74)**

DIESEL ENGINE—the most powerful ever built by International Harvester Co.—with 385 hp at 2,100 rpm is presented in a four-page folder (UDT-817). **(75).**

SHOVEL CRANES—the Link-Belt Speeder LS-78 with ¾ cubic yd capacity—is detailed in a 22-page bulletin (2725). **(76)**

IMPROVED features and production advantages of the new DW21 Series G tractor and No. 470 Series B scraper are outlined in Caterpillar Tractor Co.'s eight-page bulletin (D915) entitled "Out Front For '59". **(77)**

SKID-SHOVEL Model TD-15, the International Harvester Co.'s Drott line leader, is graphically depicted in a 16-page bulletin (CR-600-1). **(78)**

TRACTORS and tractor units in the Eimco Corp. 105 series are presented in a 16-page bulletin (L-1074), featuring dozing, excavating and loading modifications. **(79)**

LETOURNEAU - WESTINGHOUSE CO., whose new trade mark is **L-W** has a 59-page item: "Earthmoving—An Art and a Science" with lots of information on the subject. **(80)**

HAUPAK coal hauler developed by Letourneau-Westinghouse Co. offers a new low in haulage costs—80 ton, 100-cubic yd at a crack at up to 40 mph. (Form TH-118). **(81)**

ALL-STEEL jeep cabs available from Kelly Mfg. Co. are shown in a four-page folder. **(82)**

DIESEL ENGINE catalog (20169) summarizes the specifications of all current Caterpillar Tractor Co. models. 8pp. **(83)**

BUYERS' GUIDE to Amsco's reversible point, two-part dipper shovel, which aroused so much interest in November 1958 NPD, is offered by American Brake Shoe Co. (J-1775-SS) 16 p. **(84)**

FLAME RETARDANT polyethylene as an insulation material for wire and cable is the subject of a technical

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paper prepared by Rome Cable Co. and Diamond Alkali Co. Rome Cable bulletin RCT 710 contains 10 tables and charts. **(85)**

Mineral Processing

PACKLESS expansion joints for control of all pipe movement in a wide range of metals, alloys and applications are described in Adsco Div., Yuba Consolidated Industries, Inc. bulletin (59-50). 73pp. **(86)**

TIMING BELT DRIVE from Allis-Chalmers Mfg. Co. is available in five different belt pitches, according to a four-page bulletin (20B8760). **(87)**

ELECTRICAL connectors catalog issued by the Electrical Products Div., Joy Mfg. Co. contains the complete line of equipment available (B 73). 12pp. **(88)**

HEAVY-DUTY belt conveyor idlers are described in Barber-Greene Co.'s bulletin (1032). **(89)**

SCREW CONVEYOR drives in the Dodge Mfg. Co. line are illustrated in a 14-page bulletin (A667C). **(90)**

A REPORT TO MANAGEMENT is the title of a 16-page brochure published by Lincoln Engineering Co., McNeil Machine & Engineering Co. discussing the application of modern centralized lubrication systems. **(91)**

V-BELT FASTENERS that make one strong joint as simply as A,B,C are described in a six-page folder (V-227) from Flexible Steel Lacing Co. **(92)**

THERMOWELD PROCESS—a sure-fire low-cost method of welding electrical connections to copper and steel—is detailed in Burndy Corp.'s four-page bulletin. **(93)**

HORIZONTAL, water-cooled, single-stage, heavy-duty compressor—Pennsylvania Pump & Compressor Co.'s 3-AT design—is presented in an eight-page bulletin (350). **(94)**

ELECTRICAL connectors catalog from Crouse-Hinds Co. describes the complete line in 48 pages. **(95)**

CREAM FORMULATIONS that provide protection against virtually every skin irritant common to industry have been developed by Mine Safety Appliances Co., according to a four-page bulletin (0403-4). **(96)**

ENGINEERING DATA on all models of the Western Machinery Co. Torque-Flow pump are set forth in Bulletin P10-B41. **(97)**

MERCO CENTRIFUGAL separator bulletin (2606) from Dorr-Oliver Inc. shows design, cites performances. 14pp. **(98)**

WATER TREATMENT equipment in the Process Engineers Inc., Eimco Corp. line are presented in Bulletin SM-1013. 4pp. **(99)**

HORIZONTAL VIBRATING screens, rip-rap and inclined screens, vibrating grizzlies and Loweave screen cloth are presented in Cedarapid's Bulletin CS-6 from Iowa Mfg. Co. 24pp. **(100)**

PORTABLE PRIMARY crushing plants from Cedarapid's are featured in Iowa Mfg. Co.'s Bulletin PP-1. 11pp. **(101)**

SPACE FILTER performance, construction and installation details of the new Mine Safety Appliances Co. Dustfoe unit are presented in an eight-page bulletin (1505-6). **(102)**

REDI-FAB BELT conveyor series designed by Barber-Greene Co. are illustrated in a catalog (1031) now available. **(103)**

RECONDITIONED MACHINERY, mine, mill, electrical, construction and industrial, from Morse Bros Machine Co. is presented in a 49-page catalog. **(104)**

SONIC SCREENING MACHINES developed by Novo Div., Industrial Enterprises, Inc. are discussed in a seven-page release. **(105)**

FROTH FLOTATION practice at Georgetown preparation plant—a paper presented before the joint meeting of the AIME and West Virginia Coal Mining Institute is offered by Western Machinery Co. (G6-B2) 8pp. **(106)**

INDEX TO LITERATURE available from Minneapolis-Honeywell Regulator Co. Industrial Division has been published (G2-1a). 20pp. **(107)**

SWEAT ABSORBER for use in safety hats, welding helmets and face shields is discussed on Mine Safety Appliances Co.'s two-page flyer (0408-16). **(108)**

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A THUNDERSTORM FIVE MILES AWAY...

Will it hold you up or blow you up?

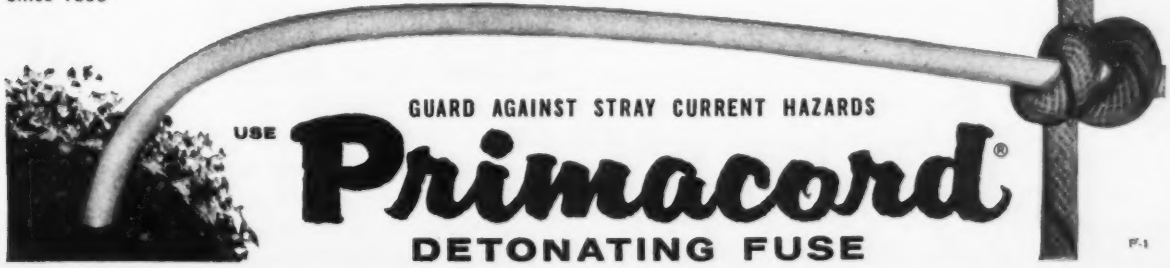
Under certain conditions, a thunderstorm five miles away can be the source of extraneous electricity that *could* result in a premature blast.
This hazard is so well recognized that blasting operations are often suspended whenever a thunderstorm is detected.

There is a simple, commonsense method of reducing this lost time while minimizing the hazard of premature shots. Use Primacord as the "down line" to detonate the charges in each hole – and as "trunk lines" to connect all holes.

Primacord is a *detonating* fuse. It cannot be set off by sparks or normal vibration – and even a direct hit by lightning failed to detonate it. Its use simplifies loading, and will enable you to plan your blasts to obtain better fragmentation.

When all is in readiness for the blast then, *and only then,*
attach fuse and cap or electric blasting cap to the end of your trunk line.
With Primacord, you call the shots!

THE ENSIGN-BICKFORD COMPANY, Simsbury, Connecticut
Since 1836



DIAMOND BITS *and* CORE BARRELS

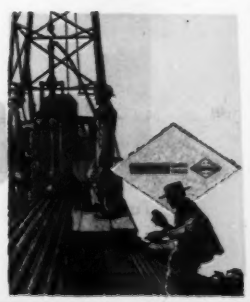
SERIES D — Core Barrel
This barrel is manufactured in EX, AX, BX and NX sizes. It comes in 10 ft. and 5 ft. lengths, and takes a core ranging in size from .845″ dia. (EX) to 2.060″ (NX). With a full floating inner tube to prevent friction grinding and minimize core wash, this barrel will recover the greatest possible amount of core even in the softer, more fractured formations. It is excellent for use in underground or surface drilling.

SERIES C-2 — Core Barrel
Increased annulus between tubes and between outer tube and hole allows this barrel to be used with either water, mud or compressed air. Manufactured with heavy wall tubing, this barrel is recommended for your heavy duty coring job. The series C-2 barrel is available in AX to NX sizes; 20, 10 and 5 ft. lengths.* Core sizes run from 1.067″ dia. (AX) to 1.875″ dia. (NX). NX size is illustrated.
*Recommend AX in 10 and 5 ft. lengths only.

3½″ x 2⅛″ Core Barrel
This barrel, similar to our Series 250P oil field barrels, is made for use with heavy duty drills. It can be used with water, mud or air and takes a 2⅛″ core. It is available in 20, 15, 10 or 5 ft. lengths.

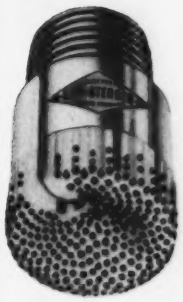
Trouble-free operation — minimum maintenance — maximum core recovery. This is what you buy in Christensen coring equipment. Equipment designed for every type operation and every size drill, from portable to heavy duty types.

Christensen manufactures many modifications and adaptations of the above equipment. For detailed information on our complete line of coring and drilling equipment, write for catalog SD507.



FOR MINING EXPLORATION

The NXD-2 pilot type bit has proved a most efficient style for core recovery in soft formations and is currently being adapted to many of our core barrels. Tungsten carbide grit hard facing is available.



The non-coring concave diamond bit cuts a straighter hole, lasts longer than conventional bits and economically cuts the hardest rock. It is ideal for drilling pilot holes, blast holes, grout holes, drain holes and cement in diamond drill holes.

This casing shoe has box thread, extra hard matrix and 25 per carat size diamonds. Casing shoes are set without inside gage stones to allow a corresponding size bit and reaming shell to pass.

This is a standard bevel wall, rib type, impregnated core bit with light diamond concentration. It is designed to overcome the problems of hard, fractured, abrasive and, in general, difficult to core rock. There is no salvage or credit value for returned bits of this type.

This balanced type reaming shell, designed and perfected by Christensen, utilizes an extra hard matrix metal that increases shell life over that of the insert type shells. There is an additional charge for hard facing.

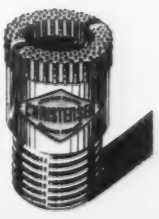
This casing bit has box thread and extra hard matrix. It is used for collaring holes and for reaming a hole for casing. It can be supplied with a pin thread.

Rock differs in drillability from area to area. Christensen will custom design your bits to insure you of drilling at "Less Cost Per Foot." May we serve you?

Diamonds Mean, "Less cost per foot."

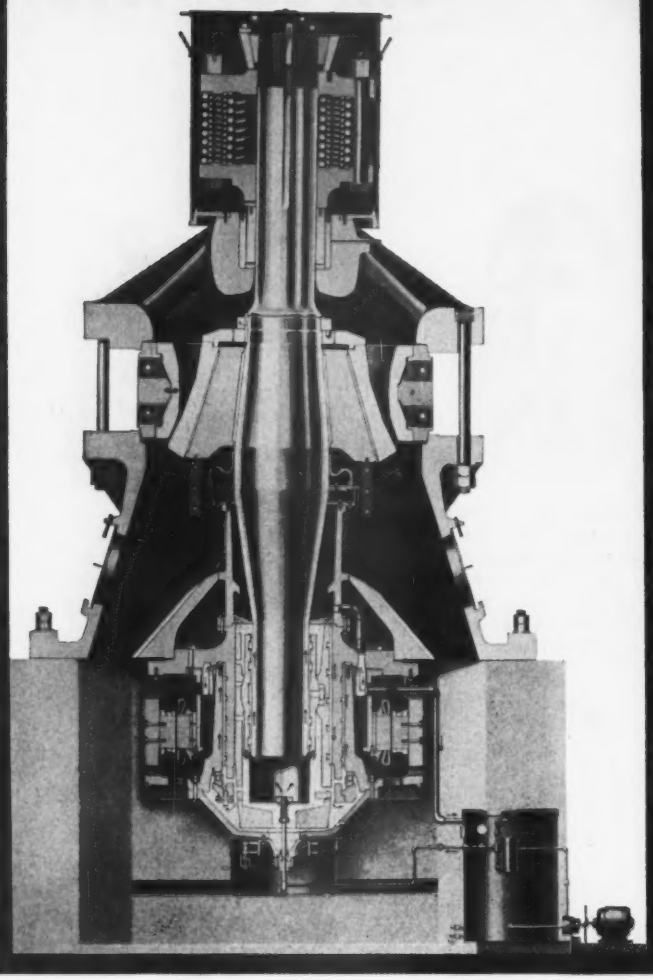
CHRISTENSEN DIAMOND PRODUCTS

1937 SOUTH SECOND WEST • SALT LAKE CITY, UTAH

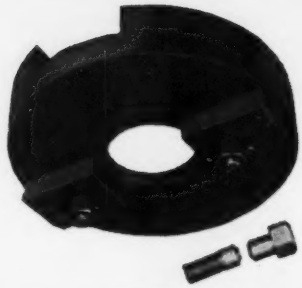


2-WAY TRAMP IRON PROTECTION

Exclusive with the KENNEDY Gearless Reduction Crusher



Ordinary tramp iron and uncrushable oversize is passed by the quick-acting, positive spring cage, without damage.



The KENNEDY patented built-in drive coupling with its overload device, provides positive protection against breakage from unusually large pieces of tramp iron. Operates only when uncrushable material enters crusher.

Uncrushable material inevitably finds its way into every reduction crusher. Only with the KENNEDY Gearless Reduction Crusher is absolute protection assured—for only KENNEDY provides 2-way protection against costly machine damage.

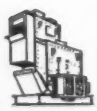
Write today for your copy of Bulletin No. 58-D describing the many other important features of the KENNEDY *Gearless Reduction Crusher.*

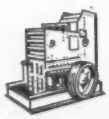
KENNEDY VAN SAUN

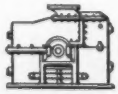
MANUFACTURING & ENGINEERING CORPORATION

405 PARK AVENUE, NEW YORK 22, N.Y. • FACTORY: DANVILLE, PA.

Primary Gyratory


Cuber Senior

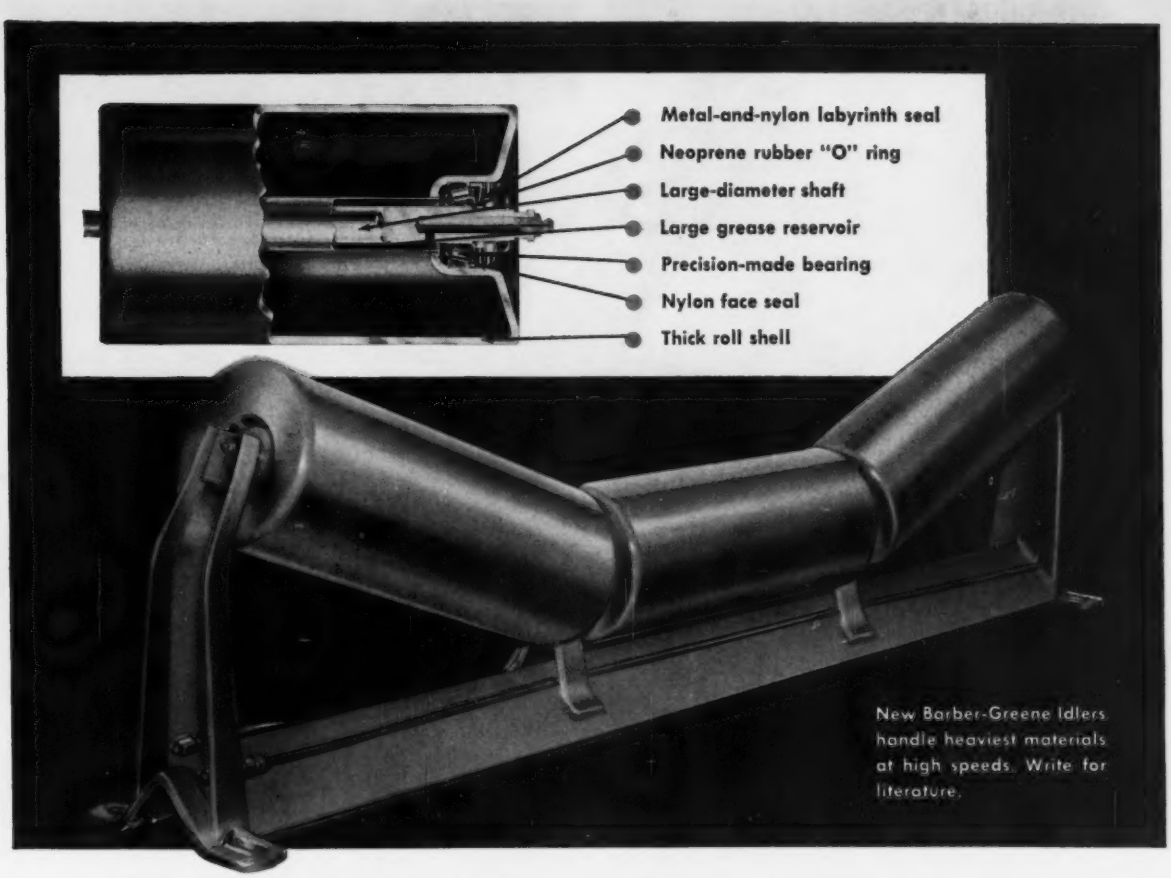

Cuber Junior


Hammer Mill

Roll Crusher

Overhead Crusher

Swing Jaw Crusher


Metal-and-nylon labyrinth seal
Neoprene rubber "O" ring
Large-diameter shaft
Large grease reservoir
Precision-made bearing
Nylon face seal
Thick roll shell
New Barber-Greene Idlers handle heaviest materials at high speeds. Write for literature.

Increase idler life with these new heavy-duty Barber-Greenes

Barber-Greene's famous line of belt conveyor idlers has now been expanded to include two entirely new series of heavy-duty units. Both series offer many revolutionary design improvements that assure longer life on every job. Both are built to handle large lumps and heavy materials at high speeds. These new series include a complete range of types for every application.

Important advantages are:

Revolutionary grease seals—The combination labyrinth and face seals are the most advanced in the industry. Made of metal and nylon, they seal grease in . . . dust and dirt out, allowing long lubrication intervals and lengthening bearing life. Neoprene rubber "O" rings effectively prevent moisture from entering bearing.

Rugged end brackets—Die-formed carbon-steel end brackets, twice as strong as castings of the same thickness, are ribbed for greater rigidity.

Precision-made bearings—Tapered roller bearings are precision-made to give many thousand hours of service.

Large-diameter shafts—Shafts, made of special-accuracy cold-drawn steel, up to 1¼" in diameter. They are firmly anchored in stands by sturdy clamps and locking plates.

Virtually unbreakable stands—Jig-welded, all-steel stands maintain roll alignment despite the impact of large lumps. Heavy, inverted base angle is self-shedding. Heavy, formed steel feet up to ½" thick.

Thick roll shells—Rolls made of heavy steel tubing up to ¼" thick. Strong welds completely around roll ends assure rugged, long-life units. Roll edges ground smooth to prevent belt wear.

Large grease reservoirs—Rigidly fitted seamless steel tubing forms large grease reservoir, providing ample reserve which permits longer lubrication intervals.

59-9-1PE

Write for new bulletin.

Barber-Greene BG

AURORA, ILLINOIS, U.S.A.

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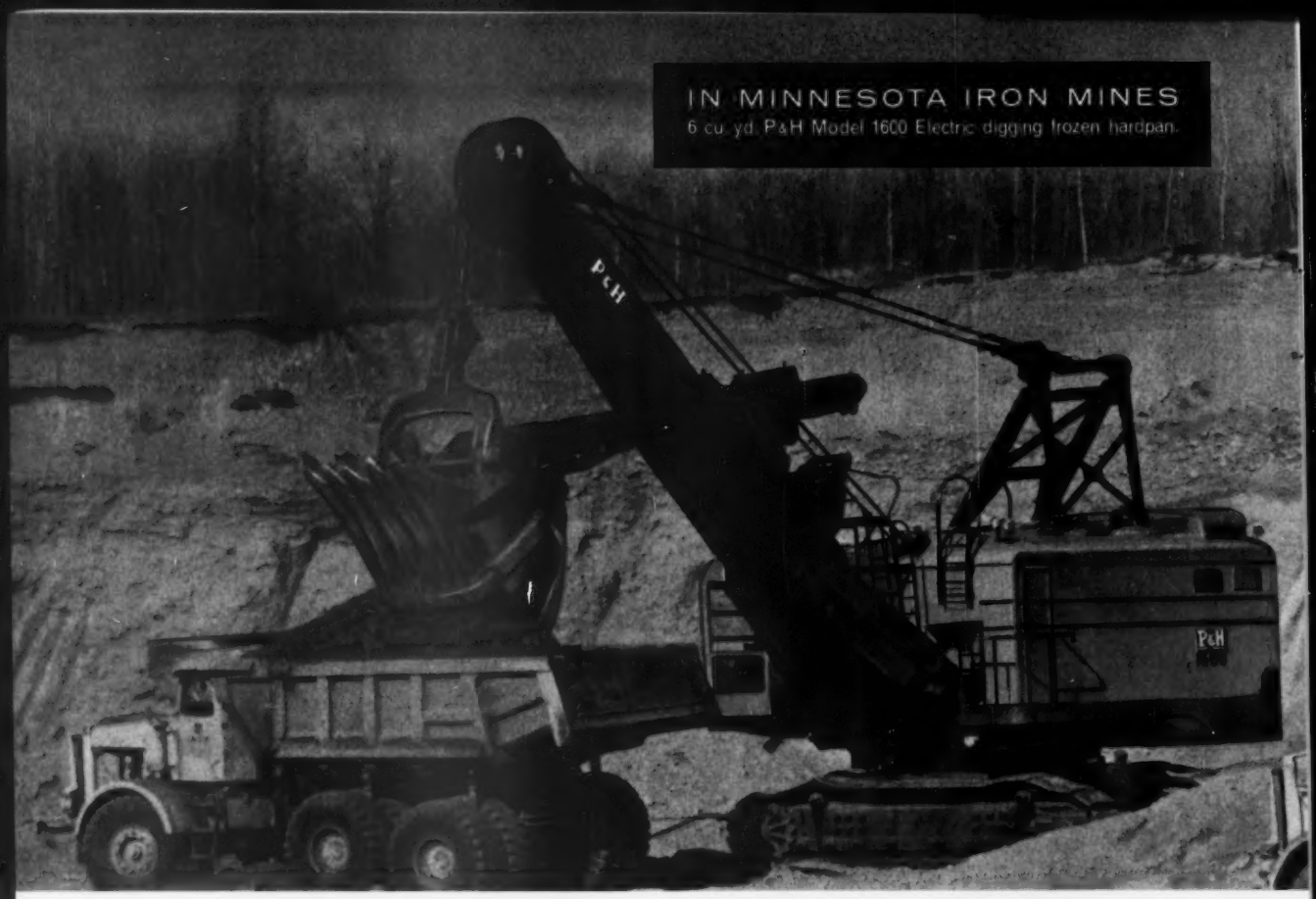

FROM THE MEXICAN TO CANADIAN

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One P&H sells another because

P&H "PROFIT·TONS" reduce loading costs... even in hardest digging

Up to 30% higher bail pull—faster swing—exceptional physical strength of P&H welded construction—greater job availability all add up to as much as 10% more production, lower loading cost per ton and *more net profit* for owners of P&H Electric Mining Excavators on their hardest digging assignments.

P&H "Profit-Tons" are the end product of these *exclusive* P&H design principles:

MAGNETORQUE* . . . the most productive digging motion drive known for electric excavators. This *patented* P&H drive electro-magnetically transmits full digging power from an A. C. hoist motor direct to the dipper without motor generator set conversion to D.C. current. It gives higher bail pull, better dipper fill factor and automatic impact protection to the digging machinery.

ELECTRONIC CONTROL . . . the most responsive control for electric excavators. This *patented* P&H control accomplishes the quickest work motion reaction time and gives the greatest cycle productivity known.

In addition, with P&H—and only with P&H—do you get the service assurance of single source responsibility. P&H manufactures their own electrical as well as mechanical components—*designed specifically for electric excavator service.* Write Dept. 556, Harnischfeger Corporation Milwaukee 46, Wisconsin.

P&H LINE:

Electric Excavators:	3½ through 10 yds.
Diesel Excavators:	½ through 3½ yds.
Truck Cranes:	10 through 80 tons

75 YEARS

P&H MINING EXCAVATORS

HARNISCHFEGER CORPORATION
Construction & Mining Division
Milwaukee 46, Wisconsin

new Athey

25-ton-capacity rear dump hauls

15% EXTRA PAYLOAD!

Tough new T-1* Steel and new T-line Design mean extra tons per haul... faster round trip time... greater operating economy!

PR619 marks the coming of Athey's new trailer line—the T-line. New T-line design combines time-proved principles of Athey Trailers—extreme maneuverability, big loading target, ground-hugging roadability, fast clean dump—with new features and remarkable new T-1 Steel. Result? A sturdier, faster, trimmer vehicle that replaces dead weight with *15% extra payload!*

*Registered Trade-mark, United States Steel Corporation.

AMAZING NEW T-1 STEEL. Around the world, engineers have hailed its exceptional toughness, its resistance to impact abuse and abrasion even at 50° below zero, its yield strength —nearly three times that of structural carbon steel. Pioneer in the use of T-1 Steel in hauling, Athey now puts T-1 Steel to work in the new rear dump PR619. T-1 Steel of 100,000 minimum yield strength equips PR619 for more punishment, longer life with less downtime, more payload, less "deadload" every trip!

T-LINE! PAYLOAD OVER 2½ TIMES DEADLOAD—possible with tough new T-1 Steel. PR619 carries over 2½ times its own weight—25 tons or 20 cu. yds. heaped on a 2:1 slope.

T-LINE! 225 HP, 30.2 MPH—power comes from the husky new Caterpillar No. 619 Tractor, reserve power for high speeds on steep rugged hauls.

T-LINE! BIGGER LOADING TARGET—13'7" by 9'2½". PR619's new flared T-line body top increases target area without increasing trailer width—speeds loading.

T-LINE! SPILL DEFLECTORS—new T-line body design of PR619 retains load—protects tires and hydraulic system during loading.

T-LINE! SELF-ALIGNING HOISTS—Two-stage hydraulic hoists of PR619 work free of bending stress... act fast, setting up straight line 57° dump angle over full trailer floor length for 12-second dump!

T-LINE! HYDRAULIC SYSTEM—features new gear type pump, full-flow filtering and four-bolt split flange fittings for top performance, long life.

T Line PR619 TRAILER

What Does Obsolete Equipment Cost You?

Hauling with yesterday's equipment puts a real squeeze on profits. Rising maintenance costs, low output per manhour and per gallon of fuel, mount up to a daily "cost of obsolescence." But this is one cost you can wipe out completely!

SEND for new brochure that shows how the features of the Athey PR619 Trailer can cut your "cost of obsolescence."

Designers and Manufacturers of Heavy-duty Loading and Hauling Equipment

Athey

PRODUCTS CORPORATION
5631 West 65th Street
Chicago 38, Illinois

PR 619

REAR DUMP TRAILER

SEND TODAY

FOR ILLUSTRATED 6-PAGE BROCHURE

ATHEY PRODUCTS CORPORATION
5631 West 65th Street, Chicago 38, Illinois

Gentlemen: Please send me your booklet, "New Athey PR619 Trailer."

NAME_____

FIRM_____

CITY_____ ZONE____ STATE_____

Questions

We've been asked about the Yieldable Arch

"How do you determine the spacing between Yieldable Arch sets?"

In general, Yieldable Arch sets are spaced 3 to 4 feet apart, though we know of installations where spacing ranges up to 6 feet. The important thing, always, is to space the sets closely enough so that the Arches and not the lagging will do the yielding. As a rule, the softer and heavier the ground, the closer the spacing.

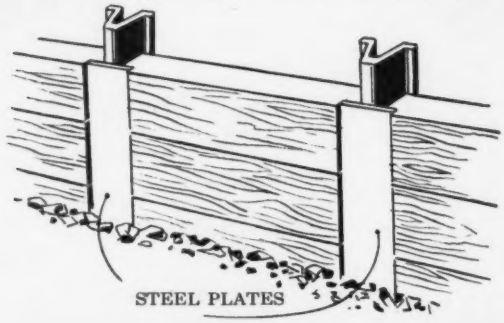
For lateral stability, each Yieldable Arch set should be tied to its neighboring set with channel struts and J-bolt clamps furnished by Bethlehem especially for this purpose. This strutting is usually installed at five points along the periphery of the Arch.

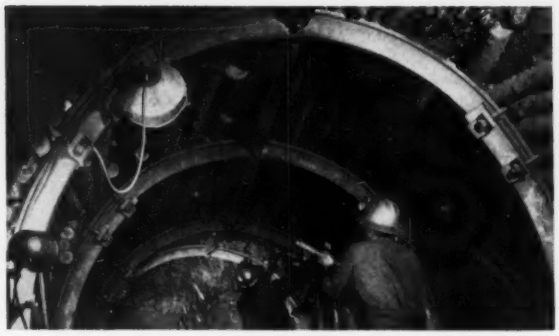
SEND US YOUR QUESTIONS

You probably have other questions of a specific nature, concerning the application of the Yieldable Arch or Ring to your mine. If so, by all means send them in; we will study your problem and reply as promptly as possible. Write Room 1041, at the address below.

"What method can you suggest to prevent scrapers from catching on the legs of Arches?"

A Michigan mine solved this problem by welding plates —about ½ in. x 5 in. x 24 in.—to the exposed edge of the legs, and then placing 4 in. x 6 in. timbers behind the plates. The timbers were notched so that the steel plates fitted snugly inside them. Note sketch below.





"Is the Yieldable Arch easily adaptable to such techniques as spiling and forepoling?"

Yes. And many mines right now are using their Arch sets in conjunction with these mining techniques.

In some upper Michigan mines, pipe spiling is used to protect the men at the face. Above the top blast holes, and angled slightly upwards, 4 to 8 holes 1½ in. in diameter are drilled 10 ft deep. One-inch pipes are inserted over the tops of the arch sets at the face, and the round is blasted. Pipes give support during mucking out, until next steel set can be placed (see photo above).

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corp. *Export Distributor:* Bethlehem Steel Export Corp.

BETHLEHEM STEEL

BETHLEHEM STEEL

TANK CAR DELIVERY OF MOLTEN SULPHUR

Loading Tank Cars at
one of our mines

...an important phase of TGS Service

This is a service of interest to the rapidly increasing number of companies preferring to receive their sulphur deliveries in molten form so that they can transfer directly from cars into consumption. We are equipped now to deliver molten sulphur by tank car from all mines and recovery plants to any place in the country. Detailed instruction sheets and drawings are available on request for those in the planning stage or who do not have adequate or proper facilities for handling and storing molten sulphur.

TEXAS GULF SULPHUR COMPANY
75 East 45th St., New York 17, N. Y. / 811 Rusk Ave., Houston 2, Texas

Sulphur Producing Units: Newgulf, Texas • Spindletop Dome, Texas • Moss Bluff, Texas • Fannett, Texas • Worland, Wyoming •

DOW **Recovery Chemicals Improve Profit Picture**

It is elementary that as a mining company's recovery processes improve, so will the profit picture improve. Difficult separations, concentrations and collections are being solved daily by new and better chemicals. The balance sheet looks better as recovery improves, and these brief chemical notes will help stimulate ideas on making the company's net income bigger.

You may wish to check certain items in this advertisement and forward to those concerned in your company.

ROUTE TO:

_____

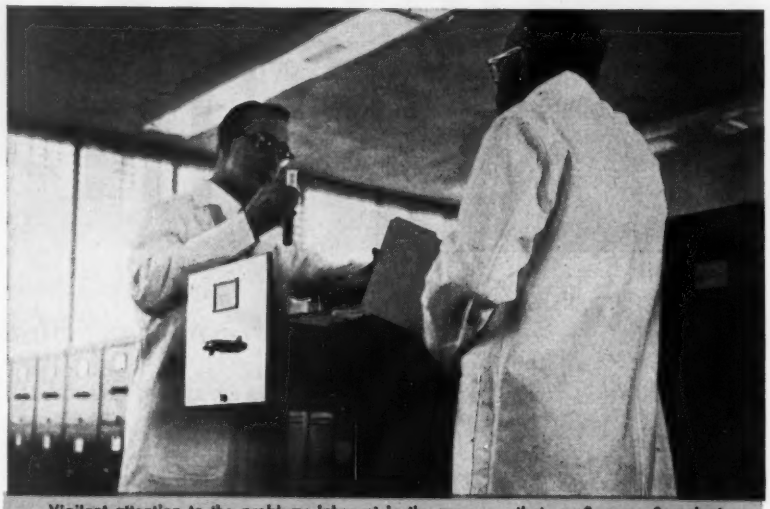
_____

_____

_____

TECHNICAL EXPERIENCE ADDS EXTRA DIMENSION TO DOW FLOCCULANTS

Separan® NP10 and Separan NP20, extremely speedy and versatile high molecular weight organic flocculants, are performing well for the mining industry. As a result, Dow's Tech Service Team has obtained a wealth of information and experience dealing with tricky liquid-solid separations. This experience makes them a willing target for hurried calls from all over the globe.



Vigilant attention to the problems inherent in the processes that use Separan flocculants has given Dow's Technical Service Team a wealth of data and information on flocculation. This collective information has helped solve many a perplexing situation.

Flocculants such as lime, glue and starch have long been used by the mining industry to improve liquid-solid separations. Since new organic materials replaced these substances in the early 1950's, the expert in the new field of faster and more thorough flocculation has been in great demand.

Dow's Tech Service Team has spent a busy five years. As Dr. Herbert Dow, Dow's founder, once remarked, "Chemicals are a good deal like little boys. In the laboratory they act like angels. Outside the laboratory, they can be devils!" Dow knew how Separan flocculants would act in the laboratory, but the key question, of course, was—what will they do in actual field applications?

The answer: Better than the most optimistic dared hope for. But experienced mining men remained skeptical. They had to be shown they would do a better job in their own backyard.

So, from the start, the Separan product was on its own. And looking back over the past five years, Separan NP10 has done its job well while convincing the skeptics. At the same time, this unusual product has also taught the men that went with it a great deal.

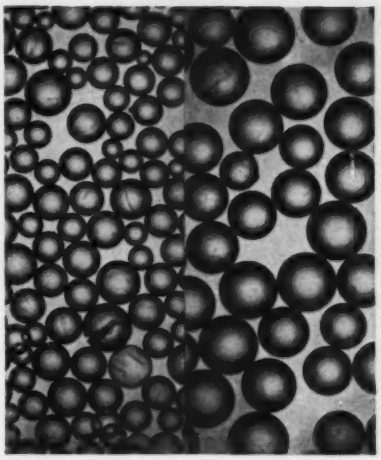
Typical examples of experience. Dow has extensive files on Separan NP10 as used in uranium mills for a variety of difficult liquid-solid separations ranging from clarification of pregnant liquors to the filtration of "yellow cake." The uranium leach problems are, of

course, similar to those of other leaching operations. Gold cyanidation is another process which presents similar problems where Separan finds use. Case histories also are available in settling, thickening and filtration situations in nickel recovery operations. Flotation plants, too, use Separan flocculants for thickening and dewatering concentrate and tailing.

More unique examples. Separan NP10 has been successfully used as an electrolyte additive in the electrolytic recovery and refining of metals. It's also being used for the recovery of flue gas solids in a number of scrubbing plants and in aiding the removal of solids from mine waters before pumping. Clarification of raw river water is another interesting application.

In the beginning, Dow could only offer the product and explain what it could do. Now, five years' experience has taught Dow and many customers just where and how Separan flocculants can improve processes and save precious recovery dollars.

It has often been said you can only learn by doing. And "doing" has surely added another dimension to Separan flocculants. When you need a fast-acting flocculant, call Dow. You'll also get some of the best technical service in the business.



21K 21K RIP

These two ion exchange resins (Dowex 21K and Dowex 21K RIP) lead the way in hard-to-manage recovery situations. Dow's technical assistance plays a major role here.

ION EXCHANGE RESINS crack tough recovery problems

Expensive and hard-to-manage recovery problems are being licked daily by the use of ion exchange resins. Dow has for years made such resins which are sold under the trademark Dowex®. This family of resins has two particular members of most interest to mill men. Both Dowex 21K and Dowex 21K RIP were developed with mining applications in mind. Their properties suit them well for concentrating metals. These two products are particularly well adapted to the treatment of extremely dilute solutions where other processes such as evaporation and precipitation fall down. At this time, they have proved very successful in concentrating uranium. As in the case of Separan flocculants, Dow's technical experience with ion exchange resins adds another dimension to these materials.

NEW MEXICO added to Caustic supply network

Grants, New Mexico, was recently added to Dow's complex system of distribution of caustic soda 50% solution. Basic production is divided among five different plants, and eight terminals in addition to Grants, N. M., provide fast service for this versatile "workhorse" chemical.

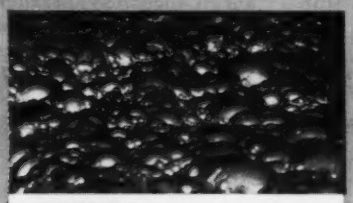
The uranium industry has found profit in using caustic to precipitate uranium from pregnant solution. Other stimulating ideas are to be found in Dow's exhaustive 86-page handbook on Caustic Soda. Copies are immediately available.

* * * *

For further information, booklets, technical papers and other literature on any of these products or others, contact your nearest Dow sales office or write: THE DOW CHEMICAL COMPANY, Midland, Michigan, Chemicals Sales Dept. 9318D6.

Four more chemicals offer

PROFIT POSSIBILITIES



DOWFROTH

Dowfroth® 250 and 400 offer a choice of two products for frothing. Excellent properties: Froth is mobile on the cell and breaks down readily in the launder.

XANTHATES

Nine different xanthates afford mill operators an opportunity to be very selective in their choice of collector . . . indispensable chemicals in the recovery of minerals.

Z®-200

The newest product in flotation reagents. Here's a tailor-made, unique collecting agent for copper minerals and copper-activated zinc minerals where rejection of pyrite is important.

CHELATING AGENTS

The family of Versene® products offers the mining industry the most complete line of chelating agents. Efficient and economical to use as filter cloth cleaner and descaler.

Dow Chemicals basic to the mining industry

Flocculants • Ion Exchange Resins
Preservatives • Chelating Agents
Ammonia • Solvent Extractants
Muriatic Acid • Frothers • Collectors
Chlorine • Calcium Chloride
Alkalies • Flotation Agents

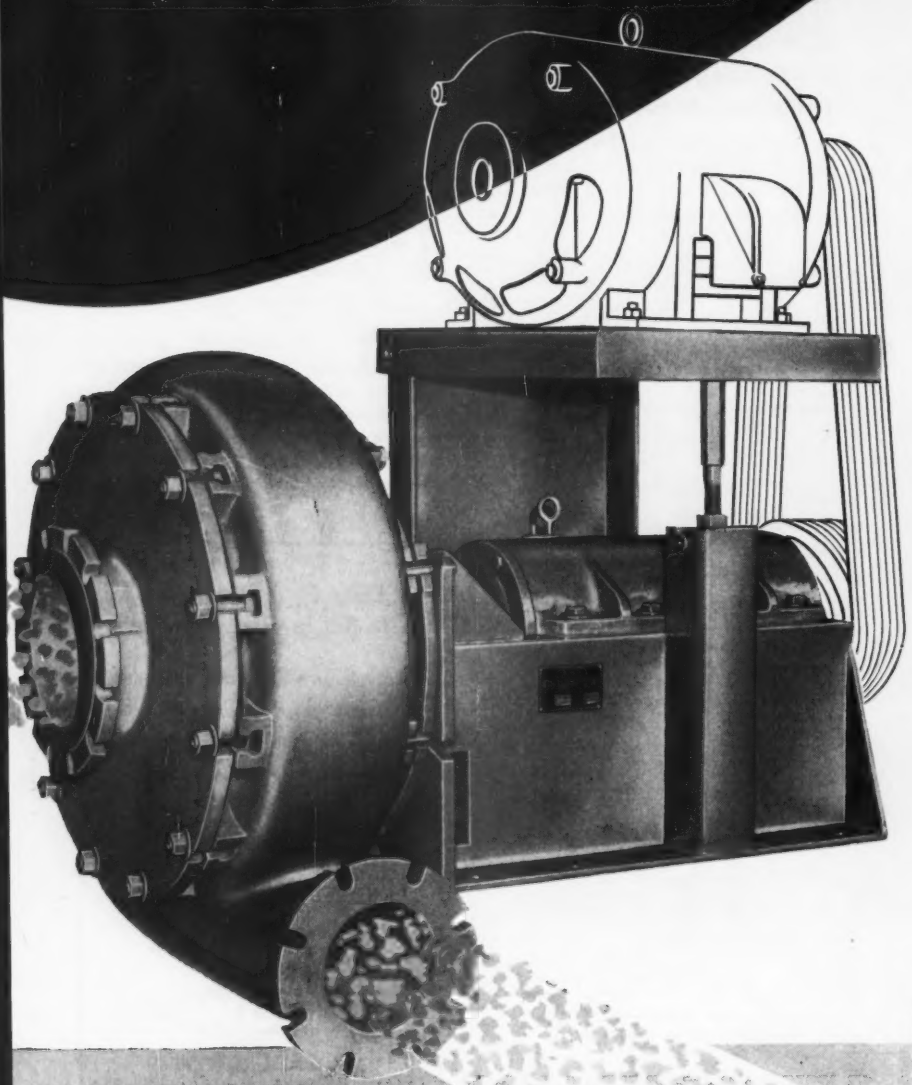
THE DOW CHEMICAL COMPANY
Midland, Michigan

DOW

Move a MOUNTAIN Through a Pipeline

Pulp, coal, chemicals, sand and gravel, all are moved quickly, efficiently and economically with

MORRIS Type CK Pumps



Hydraulic movement of materials can be simple, if you think in terms of a Morris Type CK Pump. A heavy-duty pump, with extra-wide clearances to handle larger random sizes, the Type CK is available in 4", 6", 8", 10", and 12" sizes. Engineered and constructed for long wear and resistance to abrasion and corrosion the Morris CK is available in semi-steel, ni-hard, cast steel or stainless alloys.

With the CK Pumps' low internal velocity, you get less turbulence, less abrasion, less wear and lower power costs. The Type CK features ease of maintenance, with extra clearances provided for easy replacement of packing . . . impeller readily accessible for inspection.

Morris maintains a nationwide network of centrifugal pump specialists, conveniently located to serve you. Their years of experience are invaluable when you plan a pump installation. For complete CK Specifications, and the name of your nearby Morris representative, write . . .

MORRIS MACHINE WORKS
BALDWINSVILLE, N. Y.

MORRIS
CENTRIFUGAL PUMPS

SALES OFFICES IN PRINCIPAL CITIES • EXPORT OFFICE: 50 CHURCH ST., NEW YORK 7, N. Y.

GET INTO the PROFIT CYCLE and Stay There with a JOHN DEERE CRAWLER-LOADER

THE John Deere 831 Loader has what you need to take up the slack in cycle time! New Diesel and gasoline engines deliver more power than those of any previous John Deere Crawlers. New operating speeds and a heavy-duty transmission put this increased power to work for you at top efficiency. Manual clutch-type direction reverser speeds those trips to the truck, and self-leveling bucket steps up both loading and dumping. All controls are easy to reach—easy to operate.

Better see this time-saving unit in action for yourself—get your own hands on the controls. Your John Deere Industrial dealer is ready to give you a demonstration on your job. Write today for detailed literature.

John Deere
Industrial Division
Dept. 551, Moline, Ill.

John Deere Credit Plan Aids Many Operators

To get these units on the job sooner, many contractors and operators buy dozers, loaders, scrapers, and other units through terms of the John Deere Credit Plan. Ask your dealer.

JOHN DEERE

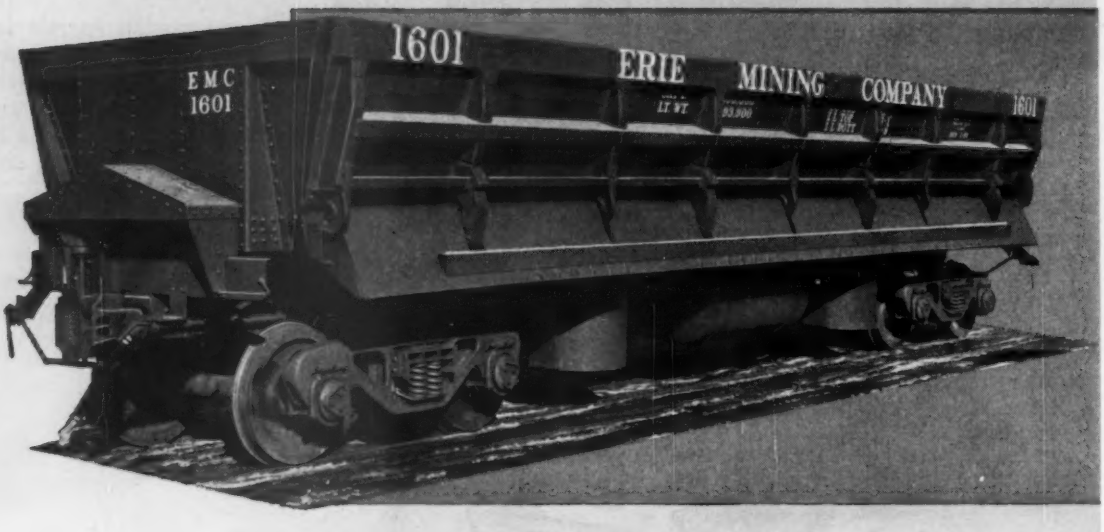
"Specialists in Low-Cost Power with a Heavyweight Punch"

MAGOR

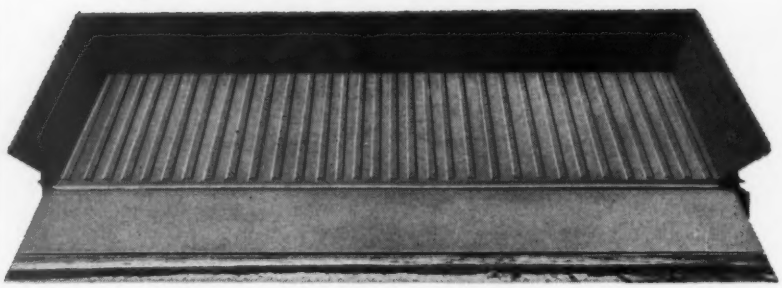
...for dependable surface mining..

Magor Automatic Air Dump Cars have set the pace for years throughout the mining industry for fast, efficient low cost service. Magor Cars are specially designed and built to take the rough, tough treatment of mining operations.

Through less maintenance, longer operating life and all 'round dependability, Magor Air Dump Cars save time and money on the job. An outstanding reason why Magor built automatic air dump cars are high on the preferred list of the nation's mining interests.



The 43 cubic yard, 100 ton capacity Air Dump Car shown here is but one of a large quantity recently furnished for a Taconite Mining operation in Minnesota. This car is equipped with a replaceable floor wearing surface of 1" thick low alloy, high tensile steel bars. These bars together with the 3/4" low alloy, high tensile steel floor afford the necessary strength to withstand the punishment of the hard rugged Taconite service.



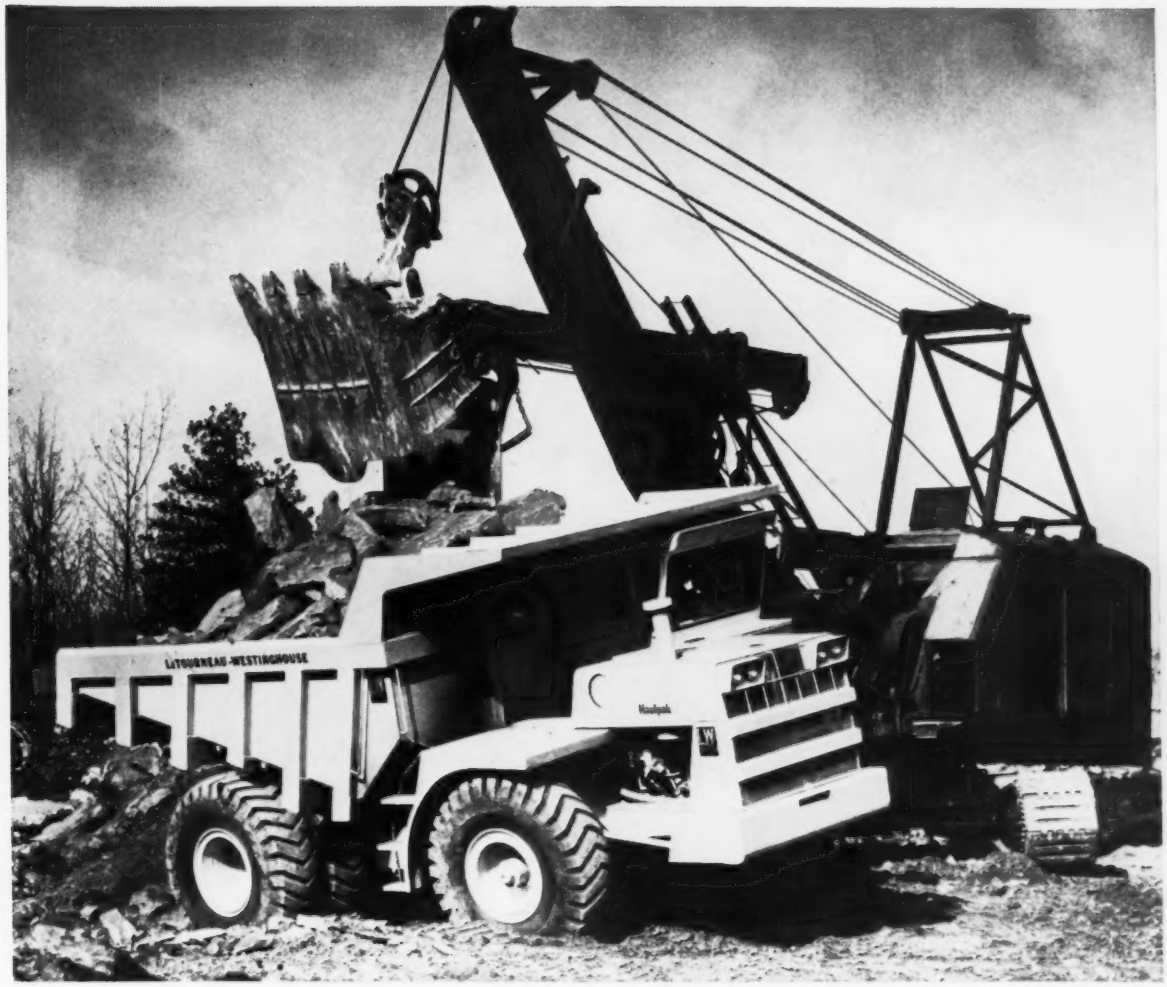
MAGOR CAR CORPORATION

Designers and Builders for the Mines & Railroads of the World

50 CHURCH STREET, NEW YORK 7, N.Y.

MANUFACTURERS OF:

AIR DUMP CARS • ORE CARS • GONDOLA CARS • FLAT CARS • SPECIAL PURPOSE CARS • COVERED HOPPER CARS • HOPPER CARS • BOX CARS



JOB RECORDS PROVE

Firestones lower tire costs-per-hour!

Firestone off-the-highway tires cut costs by working extra hours on the roughest jobs! That's because they're built with Firestone Rubber-X, the longest wearing rubber ever used in Firestone tires. Tough Firestone treads and sidewalls defy cuts from rubble and shale. Exclusive Firestone S/F (Shock-Fortified) nylon bodies shrug off bruising shock and impact. There's a Firestone tread and tire design that is job-engineered for your job requirements. Call your Firestone Dealer or Store and ask about Firestone's full line of tubeless or tubed off-the-highway tires and on-the-job tire service.

Rock Grip Excavator Wide Base

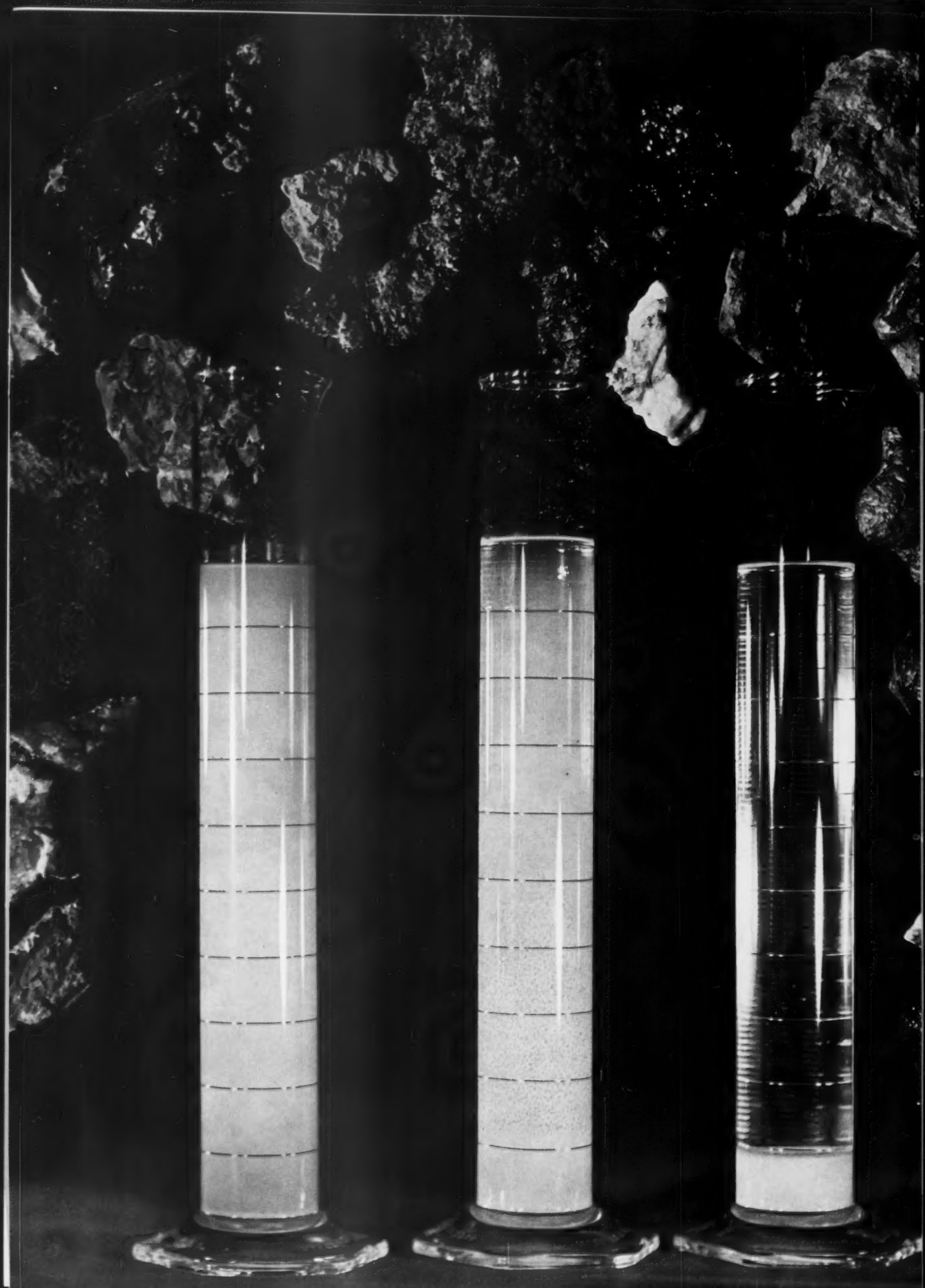
Rock Grip Excavator

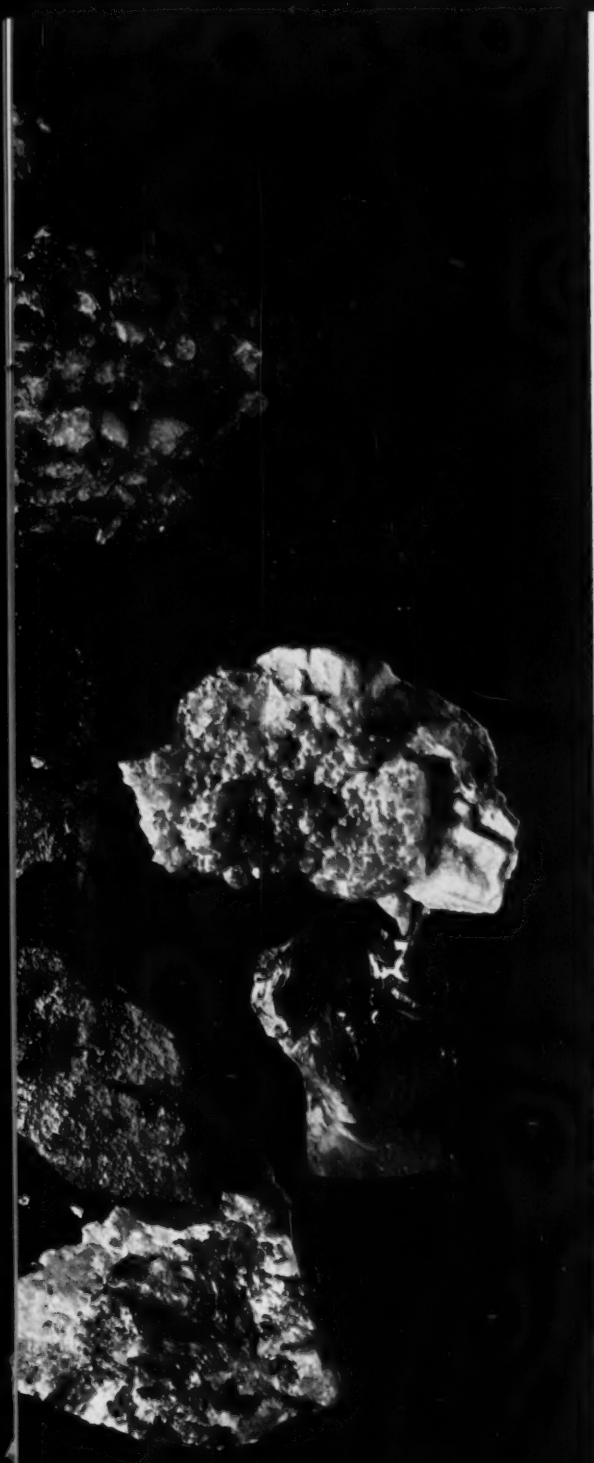
When ordering new equipment always specify Firestone tires—available tubeless or tubed.

Firestone

BETTER RUBBER FROM START TO FINISH

Copyright 1959, The Firestone Tire & Rubber Company





Non-metallic slimes settling with the aid of SUPERFLOC 16 Flocculant.

Clockwise from the bottom left the mineral specimens are: Orpiment - Fluorite Azurite - Chrysocolla - Kyanite - Bauxite Marmatite, dolomite - Carnotite - Native silver in calcite - Malachite - Native copper Heterogenite - Gold quartz - Pitchblende, gummite - Chalcanthite, pyrolusite in aplite - Gold-bearing conglomerate - Ilmenite - Native copper - Covellite - Amethyst Carnotite - Silica - Ferberite - Anthracite

SUPERFLOC* 16

FLOCCULANT

NOW COMMERCIALLY AVAILABLE

A new, highly-superior flocculating agent has been developed by Cyanamid—SUPERFLOC 16 Flocculant. This high molecular weight polyacrylamide product has consistently out-performed other synthetic and natural polymers in plant and laboratory trials as a filtration and settling aid.

Available in high bulk density, essentially dust-free form, this powerful new flocculant comes in both 50-pound bags and in 100-pound net fiber drums. Its physical properties make for easy feeding, wetting and dissolving.

Cyanamid continues to offer AEROFLOC* 3171 Reagent for those operations where a less-powerful flocculant will perform satisfactorily.

Write for free samples of these products and technical literature.

*Trademark

CYANAMID

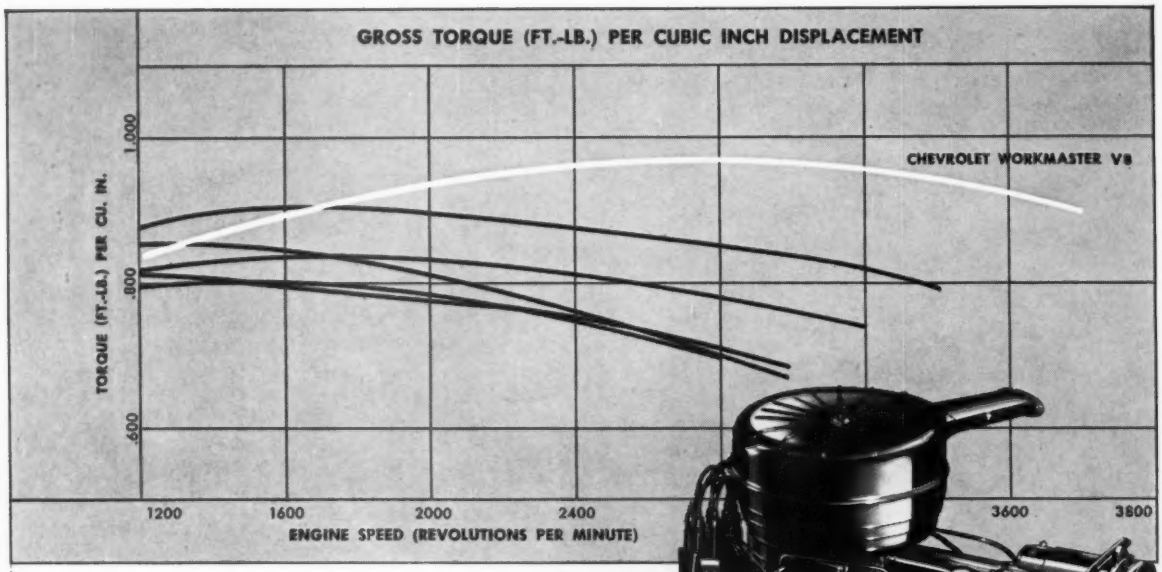
AMERICAN CYANAMID COMPANY

EXPLOSIVES AND MINING CHEMICALS DEPARTMENT

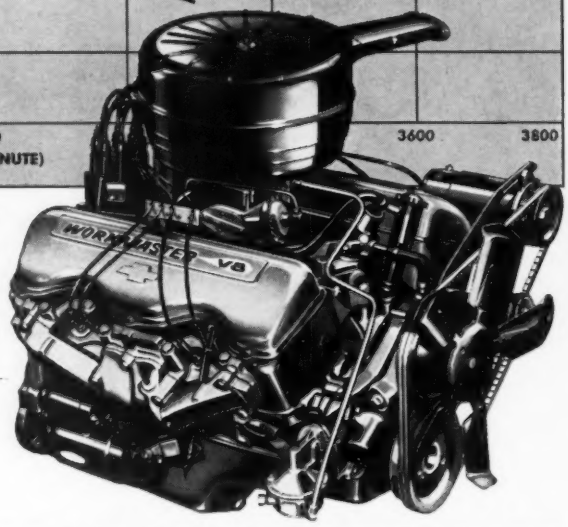
CYANAMID INTERNATIONAL — *Mining Chemicals Department*
Cable Address: — Cyanamid, New York

30 ROCKEFELLER PLAZA, NEW YORK 20, N. Y.

It's torque that beats tough jobs, and this engine has it to spare!



Proof that the Workmaster V8 puts out plenty of torque. The white curve above shows that the Workmaster provides high torque throughout the *entire range* of operating speeds. The black curves accurately represent the torque output of typical heavy-duty 6-cylinder engines of between 330 and 390 cubic inches of displacement. Curves demonstrate actual torque efficiency, based on gross ft.-lbs. of torque per cubic inch of displacement.



CHEVROLET'S 348-CUBIC-INCH WORKMASTER V8

It's torque that gives a truck plow-horse pulling ability at low speeds and assures the power to keep big loads moving, whether it's through the rough or over the road. And Chevrolet's 230-h.p. Workmaster V8 puts out a brand of torque that's made to order for your toughest big-tonnage hauls.

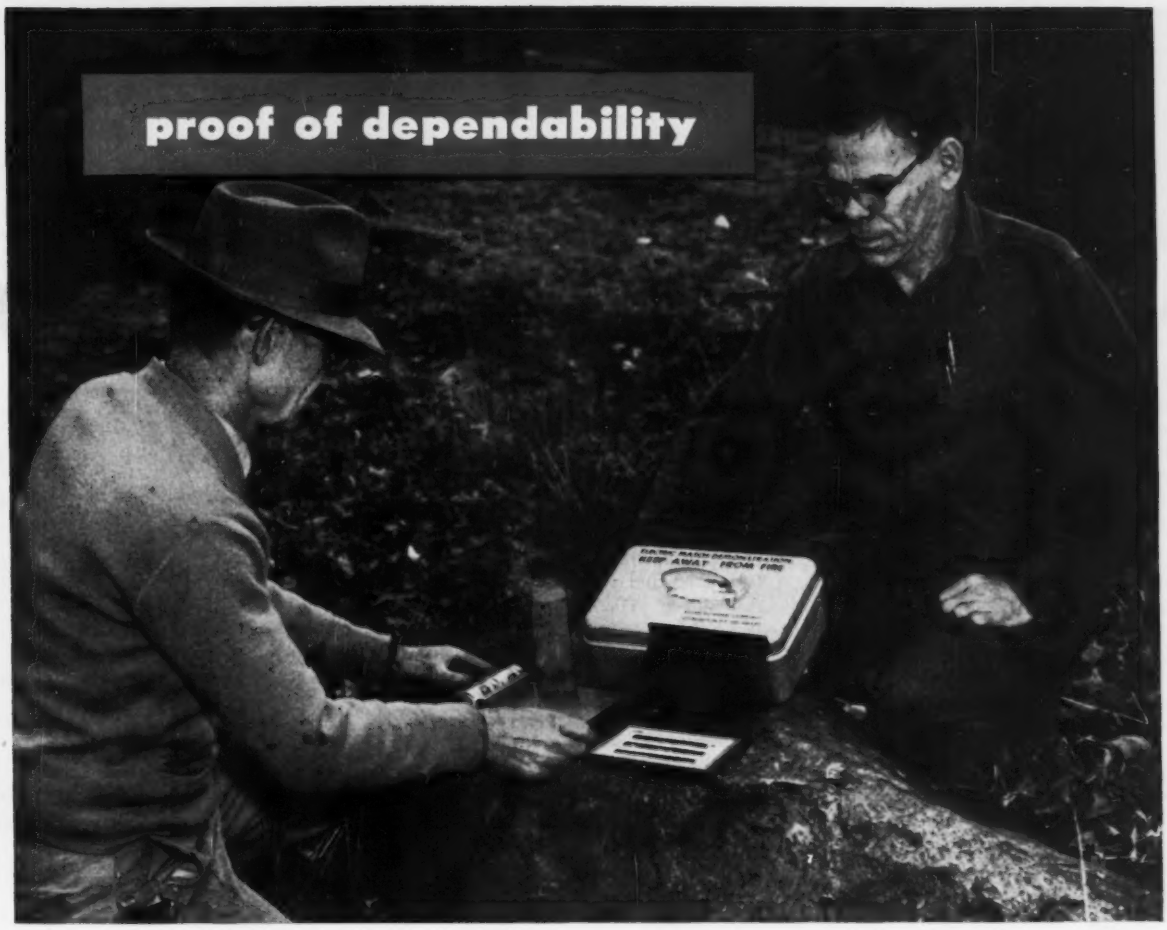
High torque output is the natural result of the Workmaster V8's unique design characteristics. Short piston stroke and large piston area, for example, comprise a torque-producing advantage, and *this engine provides the shortest stroke in its class.*

Advanced Wedge-Head design, with its fully machined combustion chambers, means high torque, too. It assures high turbulence of the fuel-air mixture and balanced power output from each cylinder. The Workmaster V8 has high volumetric efficiency . . . takes in the fuel-air mixture *efficiently* at all speeds. This, combined with a camshaft design that gives just the right valve lift and timing, assures high torque—extra pulling power to get you through the tough spots!

For the kind of torque and toughness you need to do big jobs better, see your Chevrolet dealer about a Workmaster V8, now standard in Series 90 and 100 trucks. . . . Chevrolet Division of General Motors, Detroit 2, Michigan.

No job's too tough for a Chevrolet Truck!

CHEVROLET



See this Demonstration!

Your Atlas Representative Can Show You Actual Performance of Unique Electric Match Contained Only in Atlas E.B. Caps

All Atlas Electric Blasting Caps are fired with tiny electric matches so dependable that the armed services use thousands of them in missiles and rockets.

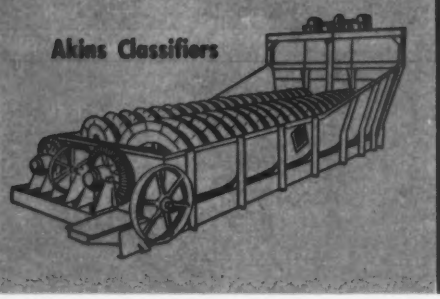
You can prove for yourself how sure-fire Atlas caps really are. Your Atlas representative has an interesting test firing kit to show you. Pick a match at random from his stock and fire it yourself . . . see how it can be depended on to fire in your blast hole.

Your Atlas man can show you *why*, too. Every part of every Atlas match is pre-tested, and the match is completed by multiple dips in high quality flash compounds.

Your Atlas representative will be glad to show you this demonstration, and to help you use Rockmaster and regular Atlas E.B. Caps for dependable initiation and timing to get effective, economical blasting.

EXPLOSIVES DIVISION
ATLAS POWDER COMPANY
WILMINGTON 99, DELAWARE
Offices in principal cities

Write for your copy of the new 60-page Handbook of Electric Blasting by D. M. McFarland and Guy F. Rolland.



Akins Classifiers

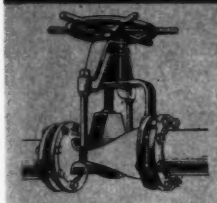
Akins HMS Separators

Akins Densifiers

Esperanza Drag Classifiers

Skinner Roasters and Dryers

Wilfley Tables



Massco-Grigsby Rubber Pinch Valves

Marcy Pulp Density Scale

Akins Classifiers

Applications

Classification of solids by size and/or gravity.
Dewatering.
Washing ore, coal, oyster shell, sand and gravel.
Desliming and deoiling phosphate rock and concentrate.

Types

Standard, simplex and duplex, for size separation, or dewatering, of coarse material.
Submerged spiral, simplex or duplex, with large pool, for separation of finer sizes.
Flared tank units provide maximum setting area and reduced overflow velocity.
Special units for handling acid or caustic solutions and salt brines.
Lifter bars and spray water box arrangements are available for difficult washing problems.

Sizes

12" to 84" spiral diameter, simplex and duplex.

Capacities

Sand raking capacity: up to 7860 tons per 24 hours (Duplex machine)
Overflow capacity: up to 2386 tons per 24 hours (Duplex machine)

Akins Heavy Media Separators

Applications

Any material that is amenable to heavy media separation of its components, such as coal, iron, manganese, fluorspar, chrome, lead-copper, tungsten, garnet, topaz, gravel.

Types

The two basic types of Akins Separators are modifications of the standard and submerged spiral Akins Classifiers.

Sizes

Spiral-diameter sizes from 12" to 84".

Capacities

Sink: up to 230 tons per hour.
Float and middling: up to 290 tons per hour.

Akins Heavy Media Densifiers

Applications

Used for recovering and cleaning medium solids.

Types

The Akins Densifier is a modification of the submerged spiral Akins Classifier.

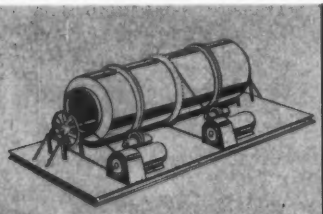
Sizes

Spiral-diameter sizes from 16" to 66".

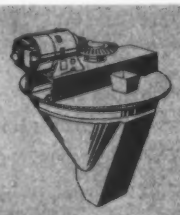
Capacities

Raking capacities up to 49.5 tons per hour.

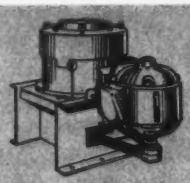
For Complete Information ...on these and other *Proved and Improved* Mine and Smelter products, write for catalogs.



Pug Mills

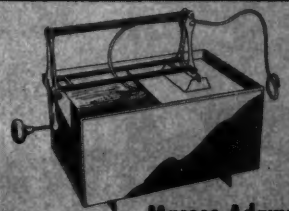


Vezin Sampler



Massco Gy-Roll Reduction Crusher

Lab Crushing Rolls



Massco-Adams Reagent Feeder

Manufacturing Division

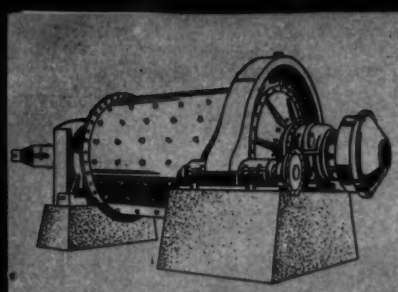
THE MINE AND SMELTER SUPPLY CO.

DENVER 16
3800 RACE STREET

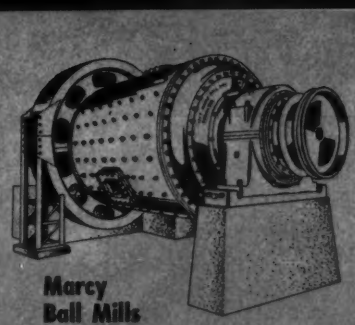
NEW YORK 17
122 E. 42nd STREET

SALT LAKE CITY 1
121 W. 2nd S.

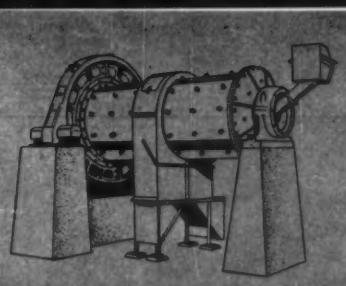
EL PASO
P. O. BOX 1162



Marcy Rod Mills



Marcy Ball Mills



Marcy CPD Rod Mills

Proved and Improved ore-milling equipment by MINE & SMELTER

Marcy Grinding Mills

Applications

Grinding materials 1½" or finer to a product as fine as 325 mesh; materials such as metallic ores, industrial minerals, specification sands, cement, brick, lime, coke, clay, chemicals, fibrous materials.
Wet or dry grinding. Open or closed circuit.

Types

Grate discharge & overflow type ball mills.
Open end rod mills.
Center and end peripheral discharge rod mills.
Tube mills — Pebble mills
Acid-proof mills — Batch mills

Sizes

29 different diameter sizes, from 12" to 12'6" inside diameter.

Capacities

Up to 6650 tons per 24 hours per mill

Skinner Furnaces

Applications

Roasting molydenum sulphide concentrates; roasting uranium-vanadium ores; drying uranium oxide precipitate; decomposition of oil sludge; lime burning; drying copper concentrates; roasting zinc ores; manganese reduction; dehydration of alunite; calcining of basic alum, lime sludges, clays, foundry sands, carbon, etc.; incineration of sewage.

Types

The Skinner is a cylindrical, multiple hearth type furnace, providing maximum flexibility, minimum dust losses, and the advantage of being able to handle sticky materials.
Gas, oil or coal fired.

Sizes

2 to 12 hearths
4'0" to 23'6" inside diameter
22 to 4000 sq. ft. hearth area

Massco-Grigsby Pinch Valves

Applications

For handling corrosive and abrasive pulps and liquids; and where remote control and/or automatic regulations are desired.

Types

Available with rubber, neoprene, or specially compounded rubber sleeves.
Manual and power driven closing mechanisms.
Can be equipped for remote control and automatic regulation.

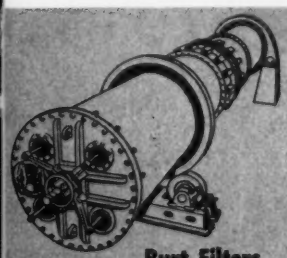
Sizes

1" to 14" inside diameter.

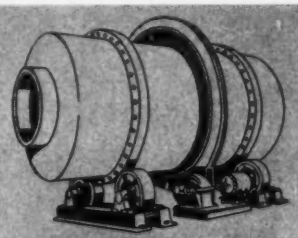
Capacities

Pressures to 150 psi.
Temperatures to 200° F.

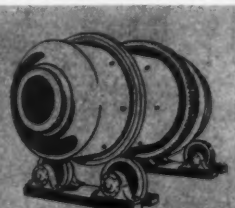
Specialized engineering and laboratory testing services available for ore-milling problems.



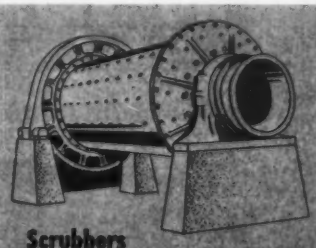
Burt Filters



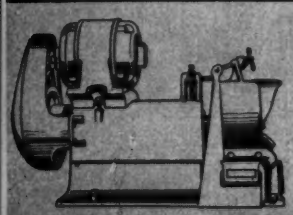
Fusion Furnaces



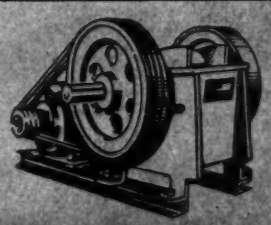
Leaching Drums



Scrubbers



Massco-McCool Pulverizer



Massco Lab Jaw Crusher

Licensed Manufacturers and Sales Agents in Canada, Australia, Sweden, England and South Africa.

Sales Agents in Chile, Peru, Philippine Islands, Japan, New York City (for Continental Europe), and in the principal cities of the United States.

THE 40-R

Ability to handle the most punishing work and be ready when you need it makes the BUCYRUS-ERIE 40-R the most outstanding rotary drill on the market, under all drilling conditions

In Granite-Hard Formations operator can exert maximum down pressure on the bit for most effective penetration.

In Soft Formations operator increases rotating speed, eases the down pressure and keeps air velocity high so that the bit will not be buried or choked in cuttings.

In Fissured Formations the 40-R instantly adapts to each new set of conditions without stopping the operation.

For illustrated bulletins on the 40-R (diesel or electric for drilling 6¾ to 9-in. holes) or the 50-R (full electric for drilling 9⅞ to 12¼-in holes) write Dept. 1B59E, Bucyrus-Erie Company, Drill Division, Richmond, Indiana.

BUCYRUS ERIE®

Builds Better Equipment

"IDEA BOOK" for cutting costs with LINK-BELT Pre-Bilt sectional belt conveyors

More than a catalog, this new Book 2779 offers many cost-saving ideas for estimating and selecting the most rugged combination of standardized components best suited to your operations. It's the ideal book for engineers and plant operators who want to keep pace with the latest developments in Pre-Bilt sectional belt conveyors. You'll see how others have solved difficult bulk materials handling problems. There's a complete section on typical layouts, and many others, to help solve your particular problem.

LINK-BELT

BELT CONVEYOR EQUIPMENT

15,191

LINK-BELT COMPANY: Executive Offices, Prudential Plaza, Chicago 1. To Serve Industry There Are Link-Belt Plants and Sales Offices in All Principal Cities. Export Office, New York 7; Australia, Marrickville (Sydney); Brazil, Sao Paulo; Canada, Scarboro (Toronto 13); South Africa, Springs. Representatives Throughout the World.

LINK-BELT COMPANY E.M.J.

Prudential Plaza, Chicago 1, Ill.

Please send me a copy of your new Book 2779 on LINK-BELT Pre-Bilt sectional belt conveyors.

Name_____

Firm_____

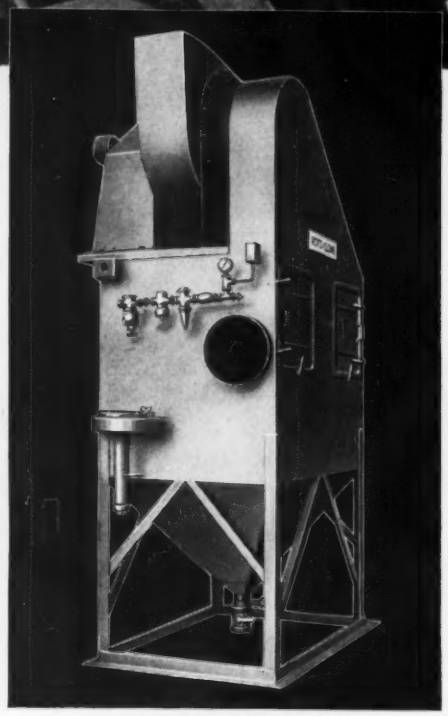
Address_____

ORE-PROCESSING

.....RIGHT...

AN INDICATION OF ROTO-CLONE ACCEPTANCE:

- *1,100,000 cfm at thirteen copper mining companies*
- *460,000 cfm at fourteen uranium milling operations*
- *1,900,000 cfm at five taconite concentrating plants*
- *2,508,000 cfm in coal mining and preparation plants*



AAF TYPE N ROTO-CLONE
Hydro-static Precipitator

DUST-PROOFED BY AAF

...DOWN.....THE LINE

Transfer, screening, crushing operations kept dust-free by Type N ROTO-CLONES

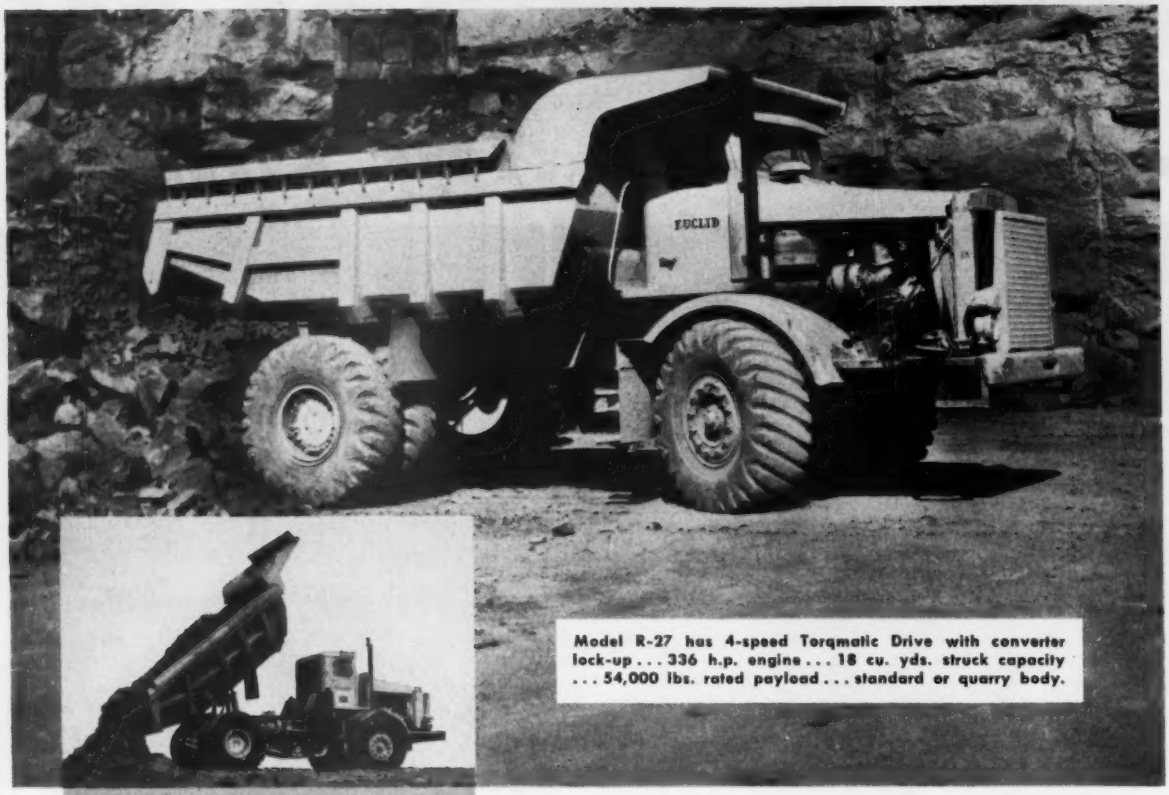
AAF ROTO-CLONES in this modern processing plant are "riding herd" on ore wherever it goes. From the first transfer point, through screening, crushing, and all the way to fine ore storage, the wet-collecting Type N's are doing a continuous dust collection job.

The rugged Type N is made-to-order for this kind of work. Its high cleaning efficiency results from the combined action of centrifugal force and the thorough intermixing of water and dust-laden air. It requires small space, features constant exhaust volume and maintained performance over a wide range of operating conditions.

And the Type N ROTO-CLONE has *proved* its mettle in literally hundreds of mining operations. For complete information, call your local AAF representative or write direct for Type N ROTO-CLONE Bulletin 277. Address: Mr. Robert Moore, American Air Filter Co., Inc., 193 Central Avenue, Louisville, Kentucky.

AAF American Air Filter

BETTER AIR IS OUR BUSINESS



Model R-27 has 4-speed Torqmatic Drive with converter lock-up . . . 336 h.p. engine . . . 18 cu. yds. struck capacity . . . 54,000 lbs. rated payload . . . standard or quarry body.

Rock Bottom Hauling Costs with Euclid Rear-Dumps

THE simple but rugged design of Rear-Dump "Eucs" has provided cost cutting performance in mines and quarries for over 25 years. This unmatched experience in building dependable off-highway haulers, combined with continuous product improvement and excellent dealer facilities for parts and service, results in high job availability and low maintenance cost.

Euclid's line of rear-dump haulers for mine, quarry and construction work is the most complete in the industry. With standard or quarry bodies, there are models with 10, 15, 18, 22, 27, 40 and 55 ton payload capacities . . . engines from 128 to 670 total h.p. . . . 5 and 10-speed transmissions and Torqmatic Drives. For close quarter work there are three over-hung engine models with semi-trailers of 12, 22 and 35 ton capacities.

Have the Euclid dealer in your area give you complete information on the models that fit your requirements. He can show you how "Eucs" cut hauling costs and bring a better return on your investment.

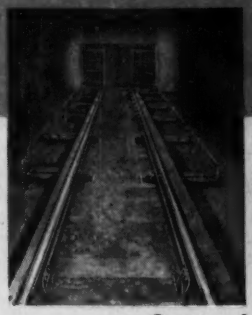
EUCLID Division of General Motors, Cleveland 17, Ohio

GM GENERAL MOTORS EUCLID

EUCLID EQUIPMENT

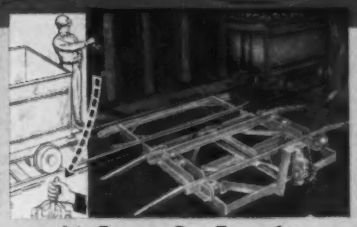
FOR MOVING EARTH, ROCK, COAL AND ORE

12 ways to coin money with "Canton" MINING EQUIPMENT



Canton Automatic Mine Doors

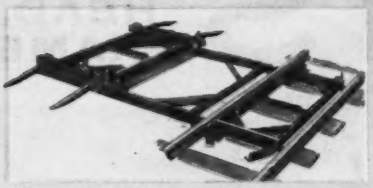
The Automatic Door operates mechanically by weight of car on activating levers. Air power operation may be had where desirable. Operates at any trip speed. Two doors provide air lock.



Air Power Car Transfer

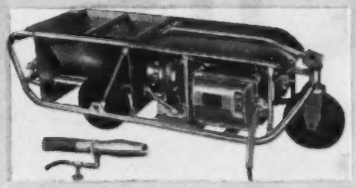
One man does the work of three and faster. Entire train loaded out on a single track. Expedites servicing cars to mucking machine.

Modernize The Cost-Less Way for QUICKER PROFITS



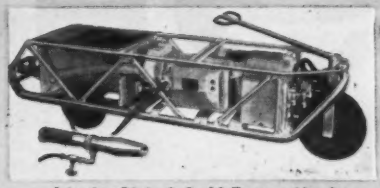
Manually Operated Car Transfer

No alterations to track—quickly installed and relocated—less rib to shoot than for jump switch—no hazards of cherry picker, antifriction bearings for easy hand operation.



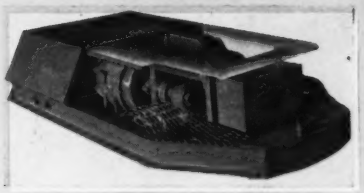
Little Chief for Wet Or Dry Dusting

Rubber tire model 23½" high—skid model 18½" high for shuttle buggies, belts or mine cars; track mounted for haulage roads. 34 to 60 lbs. dust per minute through 50 to 250 ft. of 2" hose.



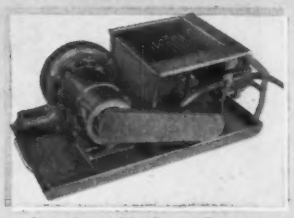
Little Chief Self Propelled Rock Duster

Hydraulically driven from a gear type pump directly connected to dusting motor. Travels up to 2 miles per hour. Wet or dry dusting. Height on tires 23½". Turning radius, its own length.



Dustmaster

The track mounted Hi-pressure "Dustmaster" is the most powerful Duster ever built. Distributes dust to back areas 500 feet from haulway.

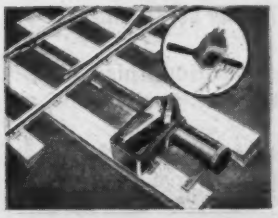


Mighty Midget Duster

Weighs only 280 lbs. Easily moved on shuttle car. Hand cart available. Ideal for small mines—inexpensive—capacity 7 tons dust per shift.

Track Cleaner

Clean entire track area mechanically in one pass—no costly hand labor, no dozers or loaders required—hydraulic controls throughout. "Pays for itself in one sweep through mine. "Now used in coal — iron — copper—lead—potash and salt mines.



Track Switch Thrower

Either electric or air operated. Route selections made by motorman at full trip speeds. Eliminates accident potential and extra man. Also ideal as Derailer. Manual or automatic contractors available.

Cable Vulcanizer

Restores insulation to original condition. Used with Canton splicers makes splice strong as original cable.

Canton Cable Splicers

Reduce down-time in splicing cable. Machine man should carry a pocketful. Just pound around cable as shown and keep on working. No special tools.

Remember you can install a "Canton" now and pay us out of savings. Write for complete brochures. Please use street and zone numbers.

Half Century of Dependable Service

The American Mine Door Company

2039 Dueber Ave. Canton 6, Ohio

This impressive installation at Kiruna, Sweden, demonstrates a major benefit of ASEA Multi-Rope Friction Hoists: *low initial installation cost.*

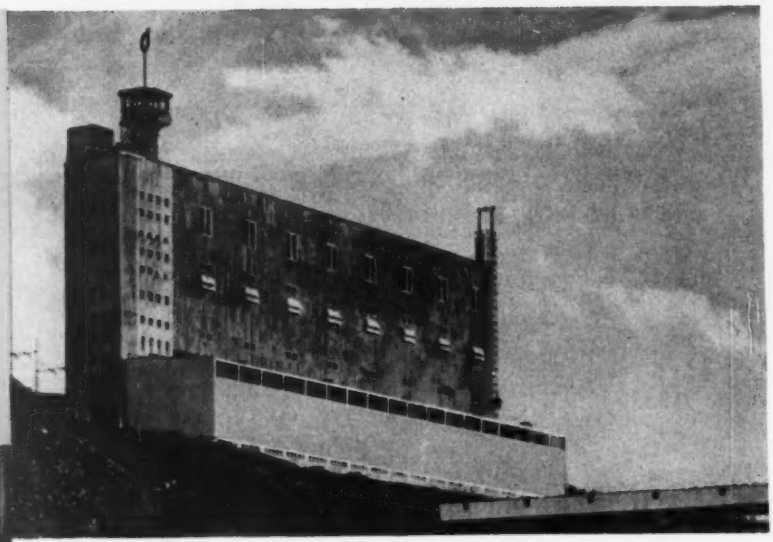
Each of these ASEA Hoists has a skipload of 22 tons and is designed for a depth of 1500 feet, maximum speed 2200 feet per minute.

At Kiruna, as in mining operations throughout the world, ASEA Multi-Rope Hoists prove less costly to operate, safer, and they reduce rope wear.

In the U.S. these advantages may be seen in the ASEA installations of National Potash Co. and

9 HOISTS IN ONE HEAD FRAME

Total capacity: 4600 tons per hour



FULLY AUTOMATIC, the ASEA Hoists at Kiruna eliminate the employment of hoist men.
At U.S. wage rates, assuming two-shift operation, this would mean a saving of about $30,000 yearly for each hoist!

Write for illustrated literature on ASEA Multi-Rope Friction-Drive Mine Hoists.

ASEA

World pioneer in electrical products for industry

U. S. Sales and Service:

ASEA ELECTRIC, INC.
formerly AROS ELECTRIC, INC.
500 FIFTH AVENUE, NEW YORK 36, N. Y.

FALK

...a good name in industry

QUALITY GEAR DRIVES and FLEXIBLE SHAFT COUPLINGS

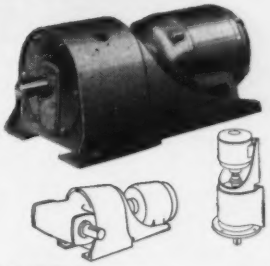
THE FALK CORPORATION, MILWAUKEE 1, WIS. *Representatives and Distributors in many principal cities.*

● The helical and spiral bevel gears in Falk gear drives assure maximum mechanical efficiency attainable—98½% per gear mesh under full load.

ALL-MOTOR MOTOREDUCERS *up to 75 hp.*

All-steel units for use with any NEMA foot-mounted motors within rated capacities of the gear drives. Standard output speeds from 1.2 to 780 rpm (with 1750 rpm motors); as low as .032 rpm in semi-standard designs. Also Integral units, from 1 to 40 hp.

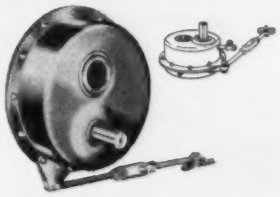
Ask for Bulletin 3100.



SHAFT MOUNTED DRIVES *up to 50 hp.*

All-steel units, horizontal or vertical. Output speeds between 420 and 5 rpm. Maximum torque rating at low speed shaft: 41,000 lb-in. Consult Factory for higher capacities and for flange mount and screw conveyor drives.

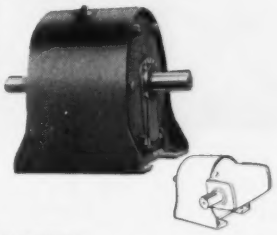
Ask for Bulletin 7100.



SMALL SPEED REDUCERS *up to 138 hp.*

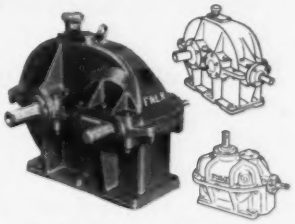
Concentric Shaft Ratios from 1.49:1 to 970:1. Max. torque at low speed shaft: 80,000 lb-in. **Right Angle** Ratios from 5:1 to 1460:1. Max. torque at low speed shaft: 73,000 lb-in.

Ask for Bulletin 1105.



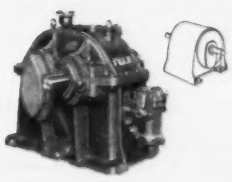
LARGE SPEED REDUCERS *up to 3500 hp.*

Parallel Shaft up to 3500 hp. Ratio range: from 2:1 to 300:1. Max. catalog torque at low speed shaft: 1,950,000 lb-in. Bulletin 1110B. **Right Angle Horizontal** up to 1000 hp. Ratio range from 1.5 to 515:1. Max. catalog torque at low speed shaft: 569,000 lb-in. Bulletin 2105B. **Right Angle Vertical** up to 760 hp. Ratio range from 6:1 to 430:1. Max. catalog torque at low speed shaft: 714,000 lb-in. Shafts up or down. Bulletin 2110B.



HIGH SPEED DRIVES . . . *reducers or increasers.*

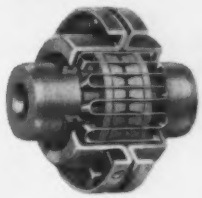
Parallel Shaft Cataloged units up to 5,000 hp or 10,000 rpm. Ratios up to 40:1. Bulletin 1105. **Concentric Shaft** Cataloged units up to 225 hp or 4500 rpm. Ratios up to 25:1. Bulletin 1106.



STEELFLEX COUPLINGS *protect connected machines.*

Hp range: ½ through 72,000 hp at 100 rpm. Exclusive grid-groove design cushions shock loads, accommodates reasonable degrees of shaft misalignment. Basic Type F for 9 out of 10 industrial applications, horizontal or vertical.

Ask for Bulletin 4100.

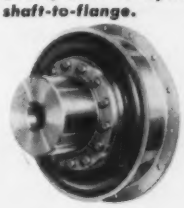


Basic Type F

AIRFLEX COUPLINGS *Designed for mounting shaft-to-shaft, shaft-to-flywheel, or shaft-to-flange.*

15 sizes covering a range from 5 through 2880 hp at 100 rpm. Ideal for applications which have irregular torque characteristics in driving or driven machines (internal combustion engines, reciprocating compressors, etc.).

Ask for Bulletin 8100.



SINGLE HELICAL and HERRINGBONE GEARS

Exclusive Falk extra-depth, high pressure angle gear teeth provide greater strength and protection against abrasion. AGMA ratings.

Diameters up to 18 ft.

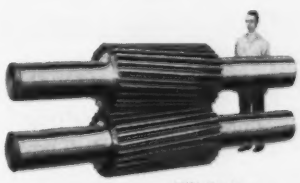
Face widths up to 6 ft.

Diametral Pitch: ¾ to 6 dp.

Hub or ring gears in solid or split designs.

Hub Gears

Ask for Engineering Reports 6170 and 6171



Mill Pinions

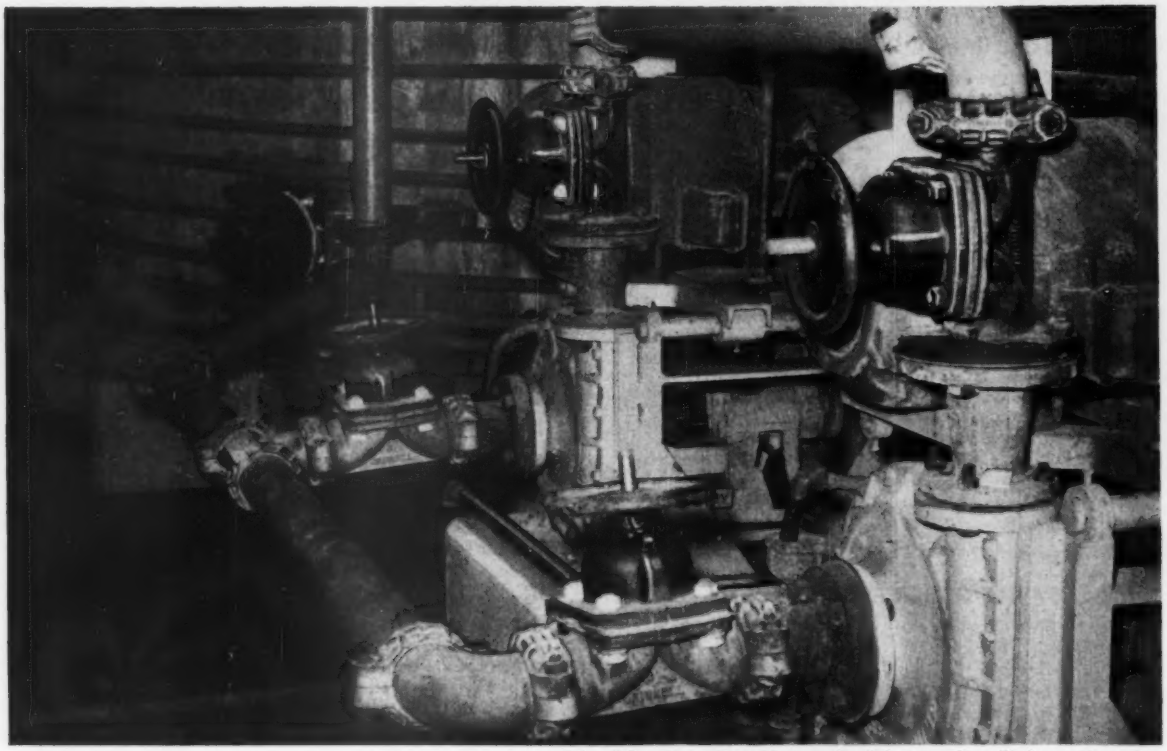
Special GEAR DRIVES for any application.

Special HIGH SPEED DRIVES . . . over 50,000 rpm.

Marine PROPULSION DRIVES for turbine and diesel.

FALK, ALL-MOTOR, and STEELFLEX are registered trademarks.

For fast, tight, dependable connections... Grinnell-Saunders Diaphragm Valves with grooved ends



Grinnell-Saunders valves with grooved ends in processing mill of a uranium mine.

Standard weir-type Grinnell valves, or the Straightway *(for straight-through flow)* enjoy wide usage on lines handling fibrous slurries, solids in suspension, sludges, semi-fluid materials, chemicals, water and gas.

Grinnell-Saunders Diaphragm Valves with grooved end connections permit flexibility in handling pipe misalignment, vibration and settlement. They also offer longitudinal tolerance which automatically compensates for contraction and expansion, and absorbs pipe length inaccuracies.

Grinnell-Saunders valves rate high in design features, too. They provide streamline flow in either direction, positive closure even when handling gritty or fibrous materials; complete isolation of bonnet mechanism; low cost maintenance — plus interchangeability of parts. Bodies are available in many different materials, including rugged ductile iron. In addition, linings and diaphragms may be had in a choice of materials to meet different conditions. Write for details.

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pipe and tube fittings • welding fittings • engineered pipe hangers and supports • Thermolier unit heaters • valves
Grinnell-Saunders diaphragm valves • pipe • prefabricated piping • plumbing and heating specialties • water works supplies
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"Imagination . . . is the source of human improvement; experience its implement"

NEW PROGRESS IN COPPER—BY KENNECOTT

Arizona has a new landmark, the world's most modern copper smelter. Its giant, 600 foot stack thrusts skyward from the desert at Hayden, Arizona, a dramatic symbol of progress in copper, a tribute to knowledge, advanced technologies and the vision of Kennecott Copper Corporation.

This marvel of copper production, utilizing the most advanced methods, industrial skills and equipment, promises substantial supplies of the much-needed red metal for a world of home and industrial uses.

WKE—Western-Knapp Engineering Co.—designed, engineered and built the new Kennecott Smelter. Close cooperation and coordination between the men of WKE and Kennecott achieved a high degree of efficiency through every phase of development.

Should you be considering plant construction or expansion, we would like to explain how the WKE approach to modern plant development results in more plant per dollar spent.

We will be happy to send additional information on the new Kennecott Copper Smelter or other projects covering a wide range of industries—on request.

W K E ®

WESTERN-KNAPP ENGINEERING CO.

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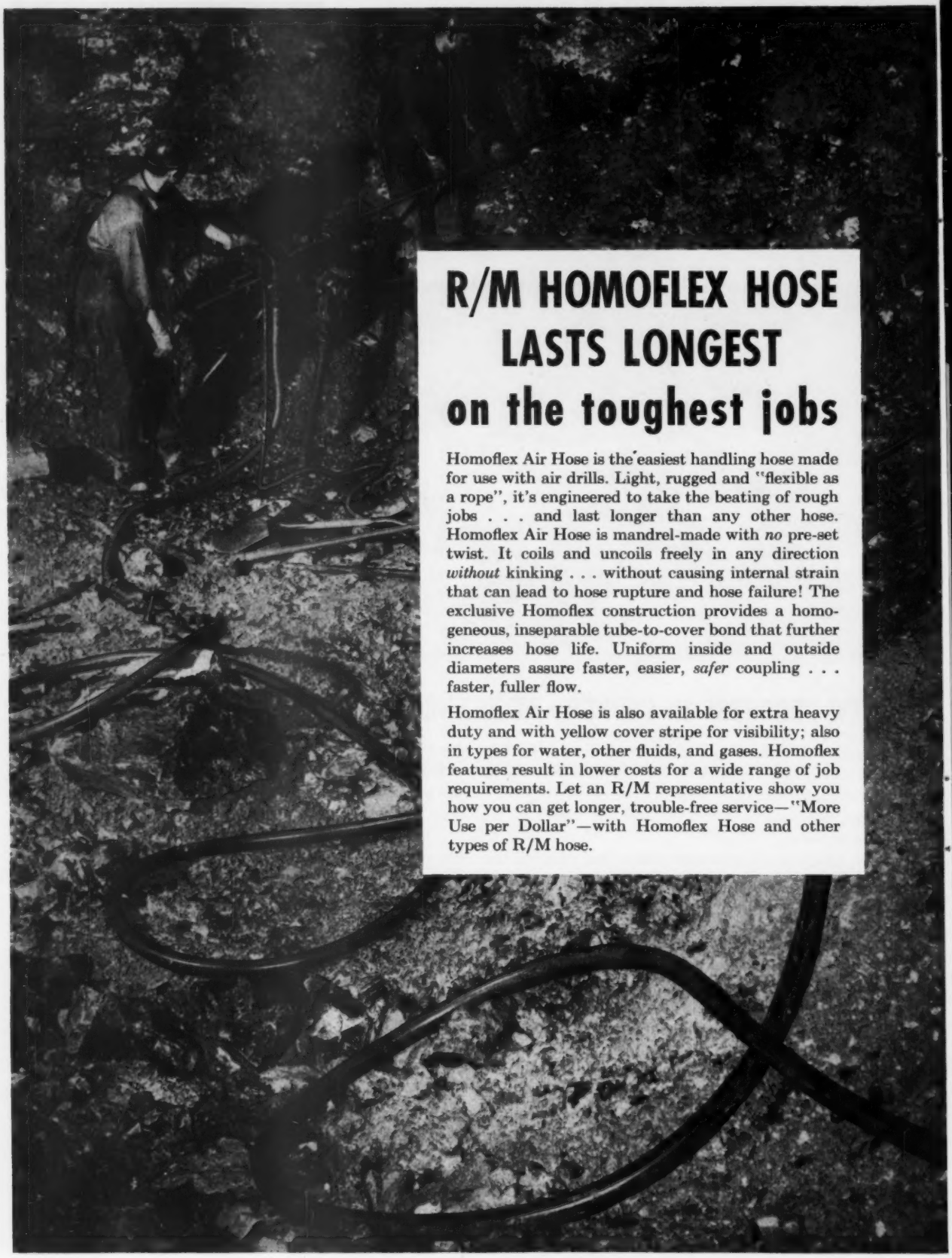
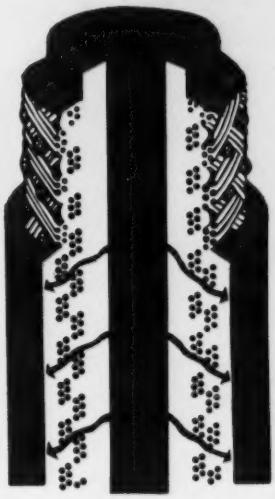
Building for the Future — in a World of Industries



R/M HOMOFLEX HOSE LASTS LONGEST on the toughest jobs

Homoflex Air Hose is the easiest handling hose made for use with air drills. Light, rugged and "flexible as a rope", it's engineered to take the beating of rough jobs . . . and last longer than any other hose. Homoflex Air Hose is mandrel-made with *no* pre-set twist. It coils and uncoils freely in any direction *without* kinking . . . without causing internal strain that can lead to hose rupture and hose failure! The exclusive Homoflex construction provides a homogeneous, inseparable tube-to-cover bond that further increases hose life. Uniform inside and outside diameters assure faster, easier, *safer* coupling . . . faster, fuller flow.

Homoflex Air Hose is also available for extra heavy duty and with yellow cover stripe for visibility; also in types for water, other fluids, and gases. Homoflex features result in lower costs for a wide range of job requirements. Let an R/M representative show you how you can get longer, trouble-free service—"More Use per Dollar"—with Homoflex Hose and other types of R/M hose.



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CONSTRUCTION

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- SUPER-STRONG
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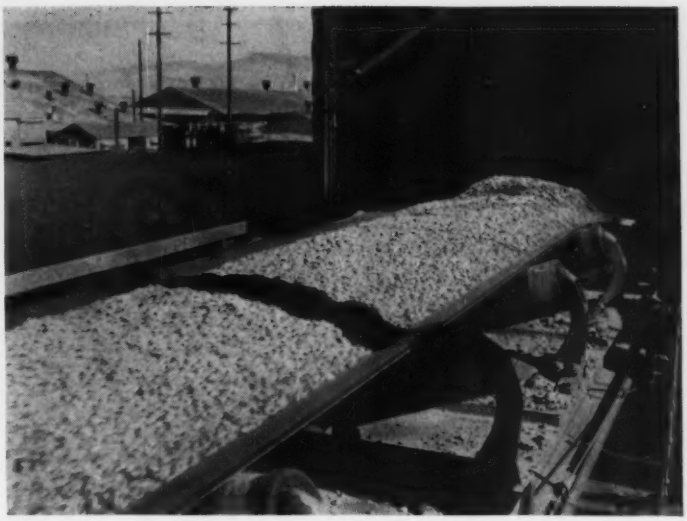
- FLEXIBLE AS A ROPE
- LIGHT WEIGHT

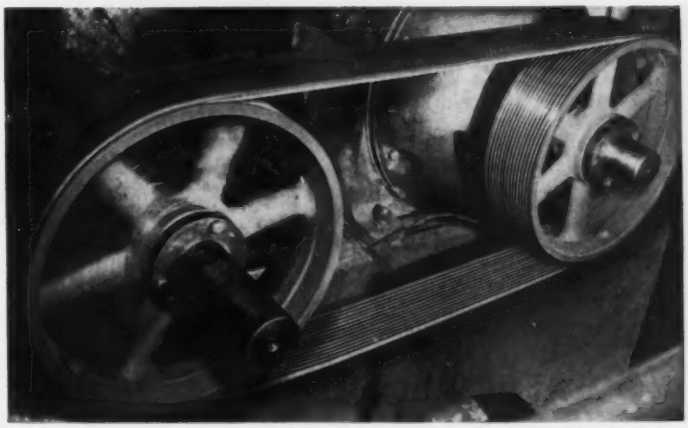
Note in cross section how specially designed braid permits the rubber tie-gum to penetrate and bond the braided plies during the plastic stage of vulcanization. This results in an inseparable tube-to-cover bond. Write for Bulletins M694 and M610.

"More Use per Dollar"



RAY-MAN CONVEYOR BELT TRAINS BETTER

Ray-Man has the extra flexibility to train naturally, trough easily . . . handle heavier loads. Cushioned strength members *plus* double compensation to relieve outer-ply stress—top *and* bottom—absorb load impact and greatly prolong belt life. Ray-Man really *holds* fasteners, is highly rip resistant . . . requires no breaker strip! Exclusive "XDC" Cover protects against wear, tear, cuts and abrasion. Check advantages of Ray-Man for your job . . . Other types include extra-cushioned Homocord for severe shock loading, and R/M Tension-Master for long lifts, high tensions. Write for Bulletin M302.



R/M POLY-V® DRIVE ELIMINATES BELT MATCHING

Single unit belt (*not* an assembly of V-belts), across full width of the drive-sheave eliminates belt "length-matching" problems. Equipment downtime and belt replacement costs are minimized. Patented Poly-V Drive has *twice* the tractive surface of a V-drive, and delivers up to 50% *more* power in the same space or *equal* power in as little as ⅔ *the space!* Just *two* cross sections of Poly-V Belt meet *every* heavy duty power transmission requirement. Greater power delivery and drive dependability begin when you specify R/M Poly-V* Drive for your mine fans and other equipment. Write for Bulletin M141.

*Poly-V is a registered Raybestos-Manhattan trademark.

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HMS CYCLONES
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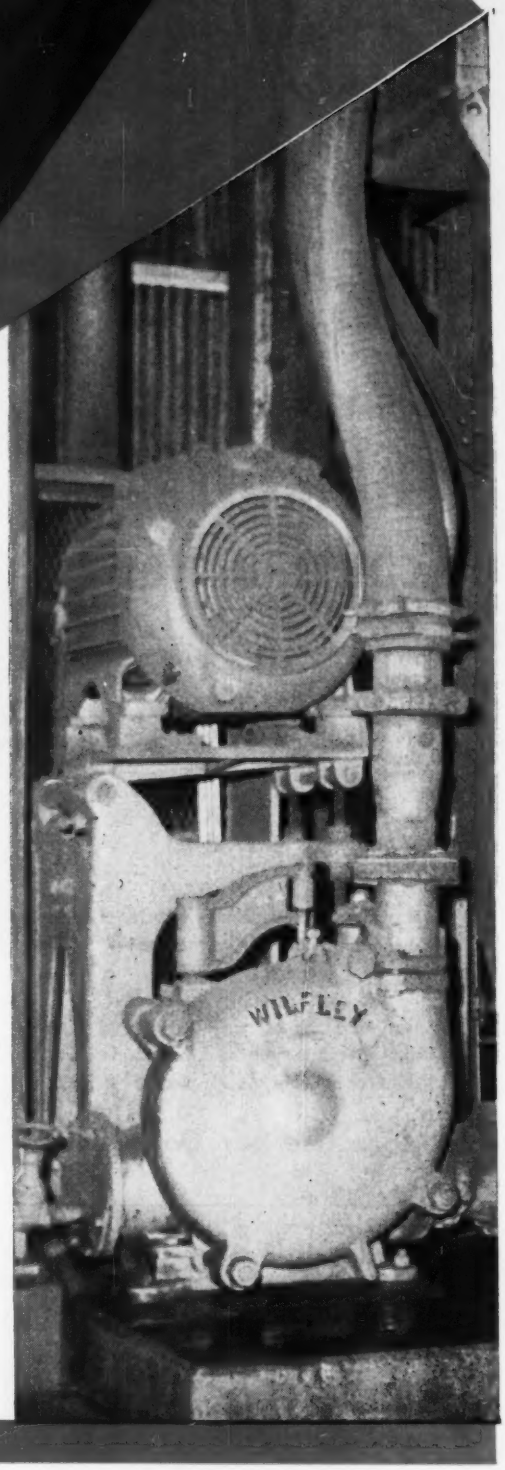
SAND PUMPS



Steady Feed
Constant Pressure

This Heavy Media Separation job called for pumps that could provide a steady feed of pulp to a set of cyclones without loss of pressure. Wilfley got the job. The simplified design and easy take-up-adjustment of Wilfley Sand Pumps make high efficiencies possible throughout the life of the parts. Trouble-free operation, built into every Wilfley pump, means less maintenance and lower pumping costs. Even under the most severe conditions Wilfley gives you this dependable, money-saving performance. Available with long-lasting parts of hard alloy or abrasion-resistant rubber.

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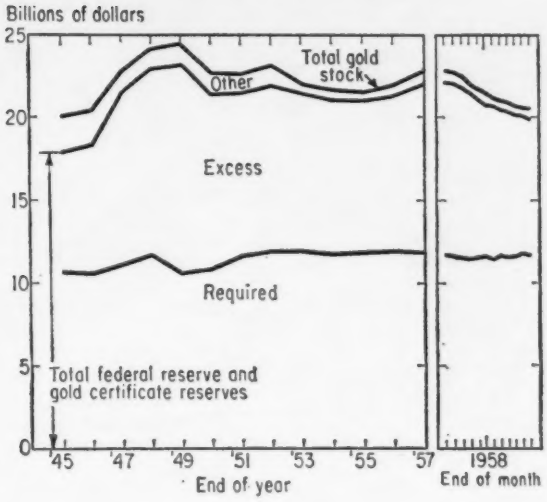
ENGINEERING AND MINING JOURNAL

JUNE 1959

U.S. Gold Stock



Changes in U.S. Gold Stock

The Facts Concerning U.S. Gold

WE RECEIVED TWO TYPES OF QUESTIONS regarding the chart showing the U.S. gold stock published in the February issue of the *Engineering & Mining Journal*. (See illustration above.)

The first concerns the ownership of the gold shown in the chart. This gold—$20.479-billion on Feb. 28, 1959, the latest date for which a full set of figures used for the purposes of this note is available—is owned by the United States. Gold held in custody in the United States for account of foreign central banks and international financial institutions—$8.616-billion on Feb. 28, 1959—is not included in the gold stock of the United States.

The second question concerns U.S. short-term dollar liabilities to foreign countries—deposits in U.S. banks and U.S. Treasury bills and other short-term paper held for foreign account at United States banks. These amounted to $15.065-billion on Feb. 28, 1959. Since on that date, out of the $20.479-billion U.S. gold stock, $11,675-billion was required as the 25% legal cover for Federal Reserve note and deposit liabilities, excess gold reserve was less than the $15.065-billion owed foreigners by the United States.

This was explicitly stated in our annual gold review (Feb. p 113) which then commented as follows on the nature of U.S. liabilities to foreign countries:

"Of this amount (as of October 1958), however, $5.8-billion ($6.3-billion, Feb. 28, 1959) was held by commercial banks, business firms and individuals largely as working balances and reserves against contractual obligations to Americans; such private holdings cannot be used to purchase gold from the U.S. unless sold to the central bank of the country concerned. The remaining $8.7-billion (same amount outstanding on Feb. 28, 1959) represented holdings of monetary authorities. Although such holdings are not legally convertible into gold, the U.S. has for almost a quarter of a century followed the practice of converting them into gold; a large part of these holdings consists, of course, of working balances to meet current or prospective payment requirements or to operate in exchange markets. Gold bought last year by foreign countries as a whole was purchased, as already noted, with currently acquired dollars, not by drawing down existing short-term dollar assets."

The review then concluded that, among other things: "the dollar is being used by much of the world as a currency in which to hold at least a part of monetary reserves and effect payments, and the U.S. gold price serves as anchor for other currencies. A flight from the dollar might be touched off if the idea gained ground that conditions were developing under which a rise in the dollar price of gold would appear inevitable. What counts, therefore, is the determination of the U.S. Government and of the Federal Reserve System to safeguard economic and monetary stability and thus prevent by deeds, and not by words alone—the spread of doubts concerning the assured maintenance of the dollar price of gold."

The annual gold article thus gave, we think, a realistic picture of the year's gold developments.

F
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The New Hayden Smelter Prepares to Take Ore From an Expanded Ray Pit

JOHN B. HUTTL

THE RAY DIVISION of Kennecott Copper Corp. is increasing pit production by 50% and blister copper production by 40% with a $40-million expansion program, started more than two years ago at the Arizona site.

Major portions of the huge expansion are the expanded pit at Ray (left), construction of the newest and most modern copper smelter in the United States (below), at Hayden, along with construction of a Leach-Precipitation-Flotation plant, also at Hayden (see p 104).

Formally dedicated Nov. 12, 1958, the smelter represents the culmination of years of brilliant planning and the latest in smelting and materials handling practice.

Specific design criteria and basic engineering was done by Kennecott's Western Mining Division engineering department. The plant was detailed and built by Western-Knapp Engineering Co. for treating about 1,000 tpd of combined sulphide copper concentrates averaging 16% copper, 30% iron, 11% SiO_2, 6% Al_2O_3, 0.1% CaO, and 36% sulphur; L-P-F concentrate with a copper content of about 27%; and copper precipitates from the Ray leaching plant containing approximately 80% copper; resulting in a production of some 190 tpd of 700-lb Baltimore-type anodes assaying 99.5% copper.

Comprehensive research and study of the designs and operation of existing modern smelters have enabled the designers, both structural and metallurgical, to incorporate in the design of the Hayden smelter new ideas and improvements. This is apparent from the orderly arrangement of equipment units, wiring, piping, extra-high buildings to provide adequate ventilation and worker comfort during the hot summer months, and latest materials handling equipment, most of it automatically controlled, launders, belts, conduits for the flow of liquids and solids through the diverse plant units.

PIT EXPANSION at Ray will mean razing of 37 buildings at Sonora (A) and eight buildings at Barcelona (B), evacuation of Ray's business district (C), and moving the shop area from (D) to section (E). A new section of Highway 177 (F), will by-pass Ray.

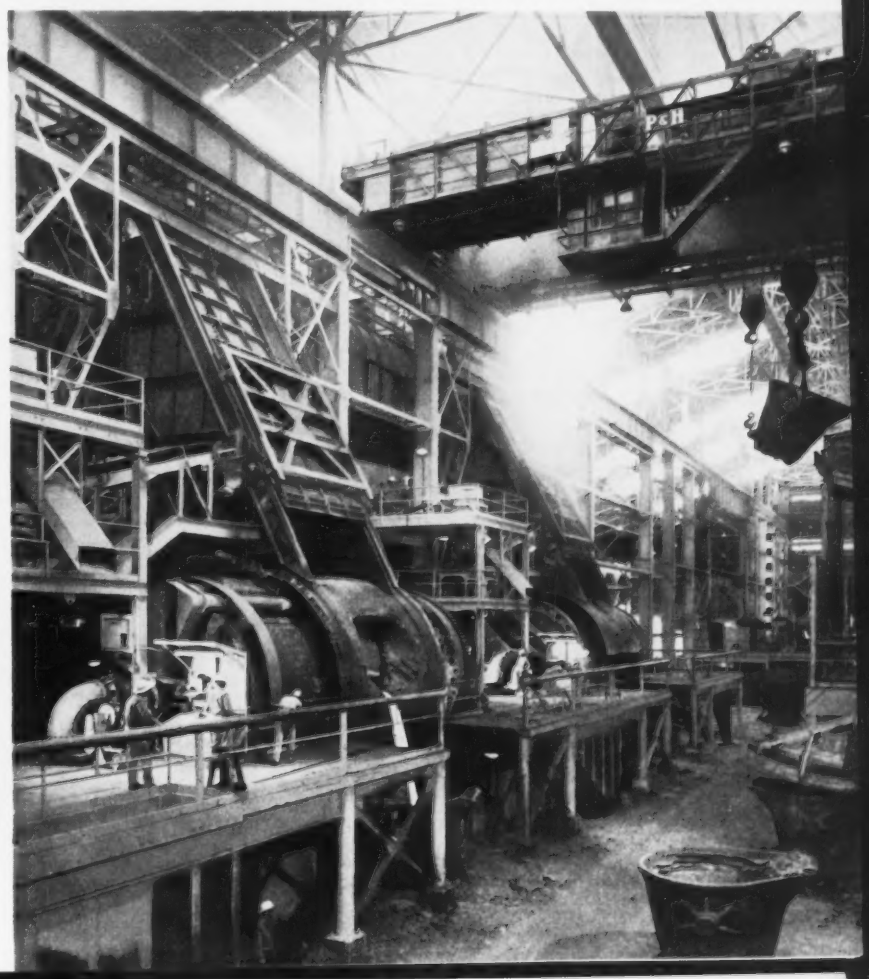
Details of some of these units are shown in the accompanying layouts, and major innovations will be described in the paragraphs covering the concentrate pumping installation, filter plant, concentrate storage building, flux crushing plant, reverb, converter, anode casting departments, and power house—the key units of the smelter.

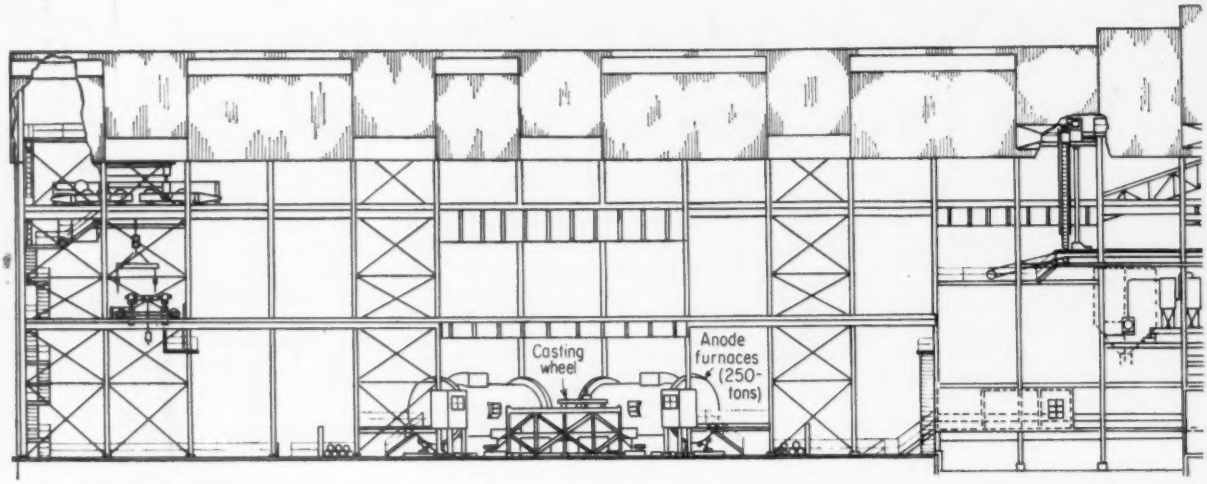
Concentrate Handling

Regular sulphide concentrates and L-P-F concentrate produced in the mill are transferred to the filter plant ahead of the smelter by pipeline transportation system. The two products, after sampling, are combined and stored in two 20-ft agitator holding tanks. Pumping of the pulp at about 27% solids by weight is done by two sets of sand pumps, one set normally on standby, connected to two 6-in. pipelines, one of which is a spare, passing through a multiplate-steelplate-arch tunnel 5x7 ft in cross-section and 2700 ft long. A return clear water line passes through the same tunnel. Total distance from the storage tanks to the filter plant is about 2900 ft, with a rise of 80 ft. The pumps are connected hydraulically in series and their speed can be adjusted for a flow rate of 400 gpm or 490 gpm, representing respectively 812 and 1,000 tpd of concentrate. Automatic drain valves interlocked with the pumps at the pumping end of the pipe lines open to drain the lines in the event of pump failure.

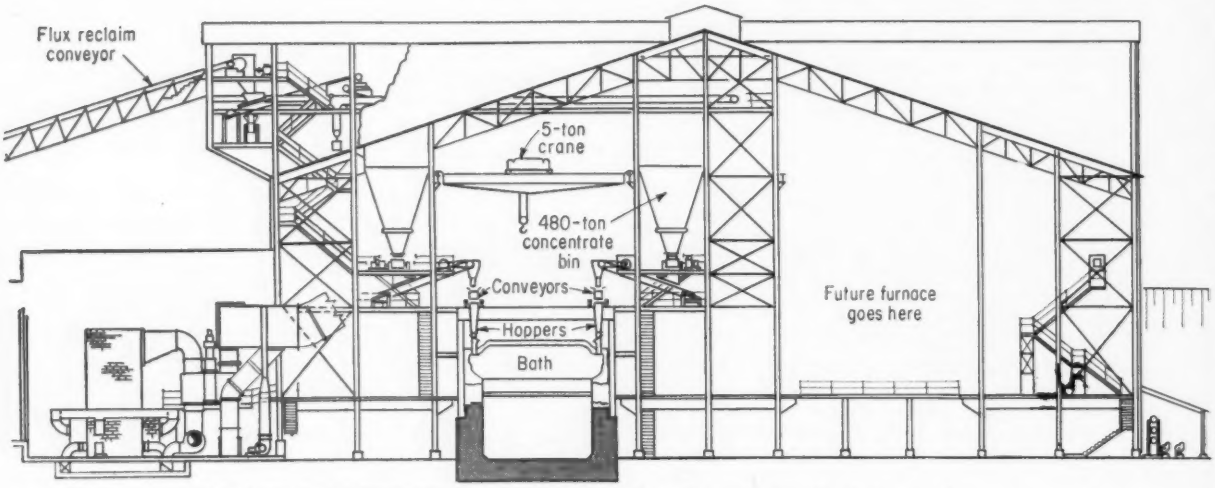
The principal purpose of the filter plant is to dewater concentrates received from the mill preparatory to their transfer to the storage building.

TWO SIXTY-FIVE TON CONVERTERS are handling the increased Ray Mines Division output. Innovations include a spark shield, new rolling door "elevators."

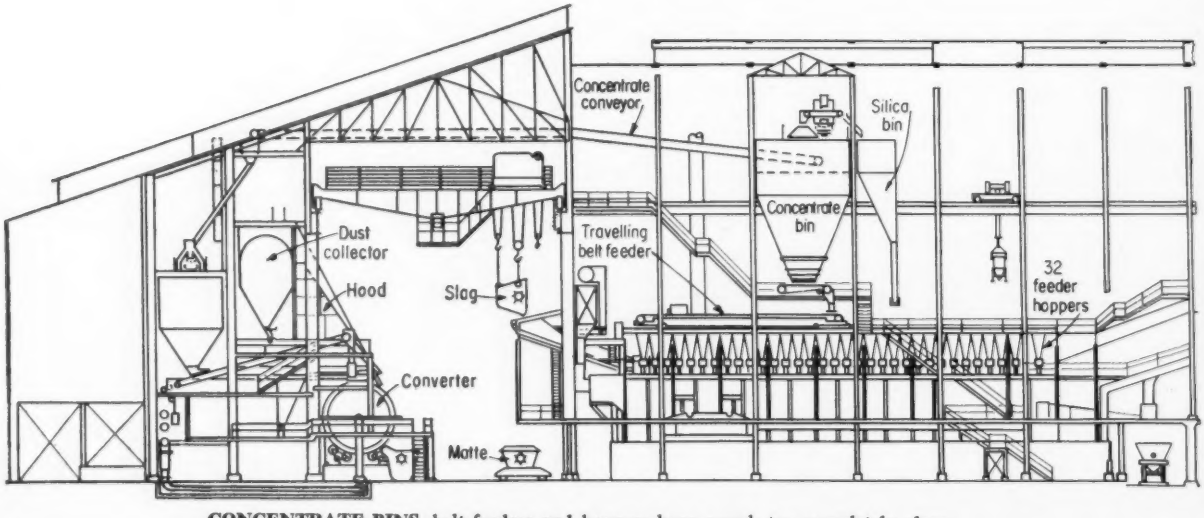




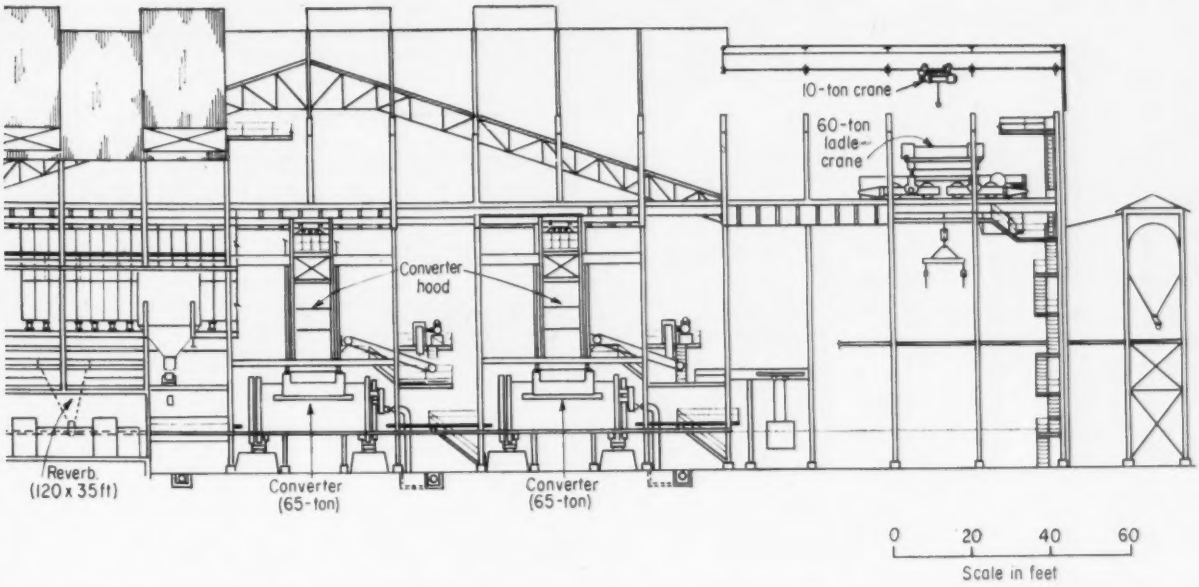
EASY-FLOWING DESIGN, detailed and constructed by Western-Knapp, speeds operation by providing room for materials handling.



FURNACE CONSTRUCTION is constant throughout the entire length of the reverb.



CONCENTRATE BINS, belt feeders and hoppers keep reverb top completely clear.



This is accomplished by successive treatment in hydraulic cyclones, thickener, and disc filters. Equipment available includes three 20-in. cyclones (one standby), 80-ft thickener outside the filter building, and three 6-ft diameter, 8-disc dual-vacuum filters (one standby). The cyclones are served by two sets of rubber-lined pumps with one set normally in operation. Concentrates at about 27% solids are fed to the cyclones at a rate of 490 gpm for 1,000 tpd at an inlet pressure of 20 psig. Underflow of about 74 gpm at 70% solids combines with that of the thickener, 50 gpm at 60% solids, and flows by gravity to the disc filters. Cyclone overflow, 416 gpm at 11.8 solids, goes via a launder to the thickener. The cake produced by the filters has a moisture content of about 10%. Filtrate is returned to the thickener for final clarification and the thickener overflow is directed to the mill through the return pipeline mentioned previously. The finished filter cake, after weighing, is transported via belt conveyor with corrugated iron arch cover either direct to the concentrate storage building at the head of the main smelter building or to the adjacent outside storage area. Plant operations are controlled from a central control room equipped with instruments to permit operation with or without an operator present. Controls are arranged to provide automatic shutdown of the plant and recirculation through the thickener in the event of equipment breakdown when plant is operated unattended.

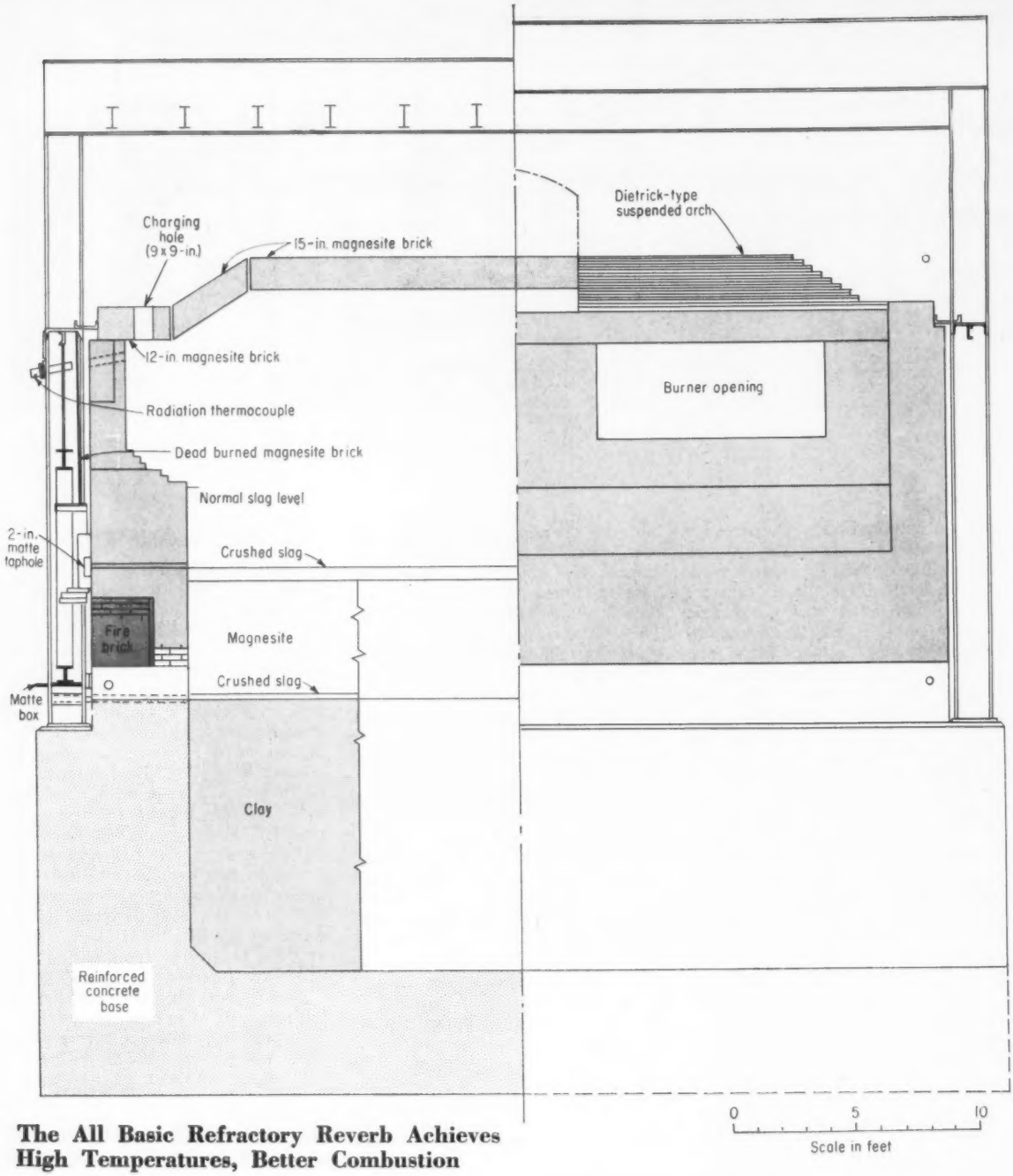
Concentrate Storage

The storage building proper houses three 2,000-ton concrete bunkers or bins for bedding concentrates and precipitates and the conveyor and crane equipment serving them. Precipitates from the leaching plant at Ray are received in gondola cars. The belt conveyor bringing concentrates from the filter plant has a moving shuttle conveyor unit at the discharge end which directs the load to any of the three bunkers mentioned. The two 10-ton overhead traveling cranes available in the building for unloading precipitates from the gondola cars, bedding and mixing them with the concentrates in the bunkers, and reclaiming the mixed product for transfer to the reverb furnace department are of unique design. Each crane is equipped with a grab bucket and a 14-cu yd capacity hopper with a 48-in. belt feeder assembly at the bottom controlled from the crane operator cage suspended below one end of the crane and rigidly attached to the crane bridge. This design permits the crane operator to move the mixed product from any of the bunkers by grab bucket to the hopper and then by belt feeder to a 24-in. gathering belt conveyor near the west wall of the building with a minimum of crane movement.

Lime rock flux stored in a 350-ton bin outside the storage building is added in predetermined amounts to the reclaimed reverb furnace feed on the gathering conveyor. Front-end loaders and a belt conveyor are used to transport concentrates from outside storage to the gathering conveyor where fluxing is accomplished. The blended and fluxed furnace feed on the gathering conveyor, in turn, is transferred to the conveyor system terminating at two 450-ton storage bins installed above the reverberatory.

Flux Crushing Plant

Mine-run silica rock from the pit at Ray is delivered to a 250-ton track hopper at the head of the crusher building in gondola cars. A 24-in grizzly covers the hopper. Lime rock and smelter reverts are brought to the same hopper in trucks and dumped into it through a special truck-size door. Reduction to desired size is done in two stages. The primary stage is effected in a 30x42-in. jaw crusher, set to give a 3-in. product, receiving feed from the hopper via a manganese-steel apron feeder 60 in. wide and 20 ft. long. Crushed material is passed by belt conveyors to a 4x8-ft single-deck screen with ¾-in. openings, with the oversize going to a secondary crusher, 10x51 Hydro-Cone unit, for reduction to ½-in., and the undersize together with the cone crusher product via a tripper equipped belt conveyor to outside storage. The cone crusher is given a finer setting when lime rock is crushed. All materials treated in the plant are stored in separate bunkers to prevent mixing. An interesting feature incorporated in the design of the crushing plant is the system of electrical interlocks to minimize the danger of accidentally mixing lime rock with the silica rock used for converter fluxing. One such interlock requires the outside storage tripper to be positioned over the lime rock storage pile before trucks carrying lime can dump into the track hopper, and before the crushing plant can be placed in operation. All conveyors are provided with interlocks to prevent material spillage and belt damage in the event of equipment failure and with an emergency trip wire which stops the conveyor and actuates



The All Basic Refractory Reverb Achieves High Temperatures, Better Combustion

the interlock system. The plant is also served by an efficient dust collecting system comprising a wet-type collector unit outside the crusher building connected by ducts to intakes available at all material transfer points.

Crushed lime rock is transported from the storage pile to the 350-ton storage bin mentioned previously by large end-dump trucks and silica rock is reclaimed through draw-down gates in a tunnel running under the storage pile and then delivered to the storage bin above the reverberatory furnace and to the storage bins behind the converters by an interlocked belt conveyor system.

Smelting Department

Principal equipment operating here includes a 120x35-ft(OD) all basic-refractory reverberatory furnace with a Dietrick-type suspended arch; three 13x30-ft Peirce-Smith converters; and two 13x30-ft anode furnaces grouped around a common anode casting wheel.

The reverb furnace structure rests on a massive and heavily reinforced concrete foundation extending about 12 ft 4 in. above the surrounding grade. The foundation encloses the furnace bottom and supports the side and end walls of the furnace. Bottom is made up of compacted clay, crushed magnetite, and fused slag. Thickness of the side wall ranges from 4 ft below bath level to 1½ ft above.

Additional construction features are explained in the cross-section shown. It will also be seen that furnace cross-section is constant throughout the entire length, and thickness of the arch is a nominal 15 in. The air-cooled uptake pilaster and the "Dutch oven" extension to the burner end of the furnace are of interest. Some 15,000 cfm of air is blown through the internal slots in the pilaster brickwork for refractory cooling purposes. The bridge wall is protected by copper water jackets positioned where cooling is most needed.

The "Dutch oven" feature makes possible higher melting zone temperatures and better combustion and heat release of the fuel. It extends about 8 ft out of the furnace bridge wall and is 27 ft long. Natural gas fires the furnace, the burner equipment consisting of eight multi-jet type, combination oil and natural gas burners at the end of the "Dutch oven." Primary air to the furnace is preheated to about 650 deg F and is proportioned to maintain ideal combustion conditions. Furnace temperature, boiler feed-water rate and level, furnace draft, soot-blowing units are controlled from one central control panel.

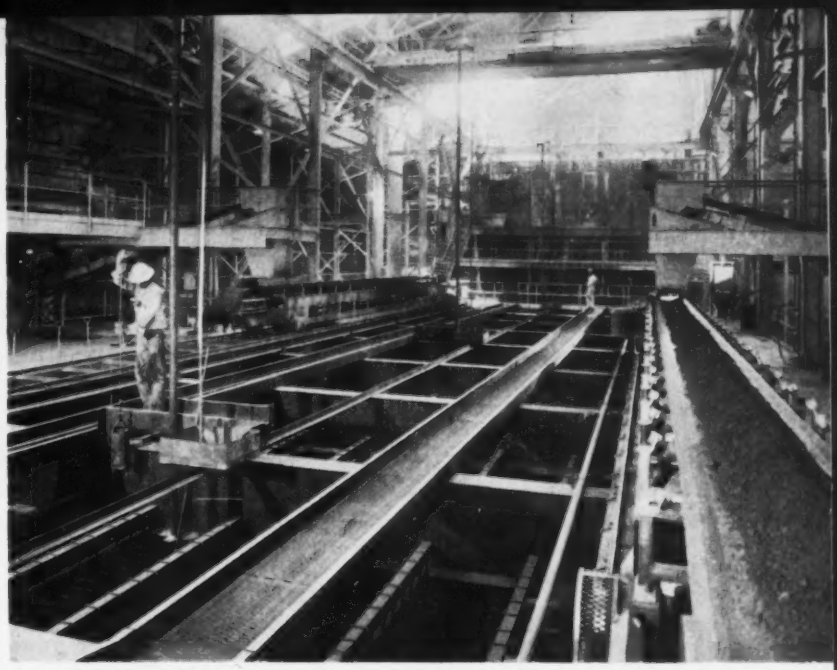
32-Hopper Feed

The furnace is side-charged through the arch by a twin feeder belt-shuttle system which drops the charge through any of the 32 hoppers or chutes placed closely along each side of the furnace. The hoppers are about 3 ft square at the top and taper to 9 in. square at the arch line. Concentrate is dropped into the furnace by a lever-controlled slide gate bolted to the hopper. The gate is designed to be self-cleaning and plug-up proof. All conveyors operating between the concentrate storage bins and furnace are pushbutton controlled from panels at strategic points. A 5-ton crane is provided to facilitate furnace and equipment repairs. The furnace feed installation described leaves the entire arch area, including the boiler uptake, free from obstructions, permitting easy fettling and arch maintenance.

Matte is tapped from the furnace through two tap holes on each side of the furnace near the burner end into a 200-cu ft ladle which rests on a self-propelled matte car. When full, the car is moved into the converter aisle where the ladle is picked up by crane and poured into the converters. The slag can also be tapped from both sides of the furnace near the uptake end and directed via launder to 225-cu ft slag cars. Converter slag is returned to the furnace via a single slag-return launder which enters the arch on the furnace center line a short distance from the burner end so that the slag stream hits the bath about 5 ft in front of the bridge wall. All tapping points have separate fume control systems to exhaust generated fumes to atmosphere. The furnace area is also served by a vacuum cleaning system. Reclaimed dust is returned to the smelting process.

The waste-heat boiler installation at the end of the furnace consists of two units, each rated at 66,000 lb of steam per hr, 450 psig pressure, and 750 deg F. The non-baffle design, apart from requiring virtually no manpower to keep the installation clean, prevents excessive draft loss. The boilers are also designed to prevent dust from slagging on the tube.

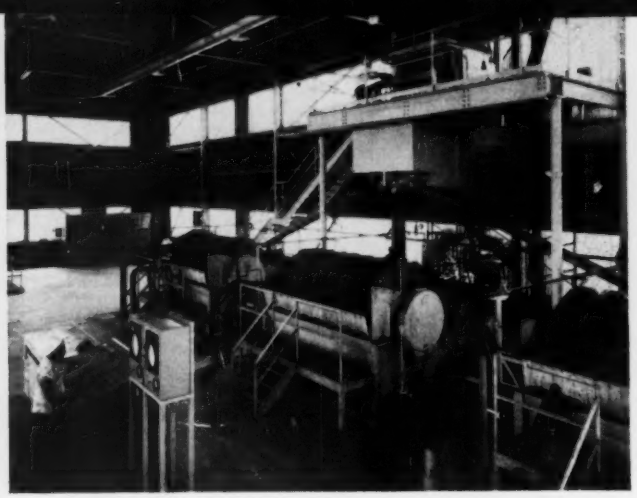
Reverberatory matte is treated in two of the three 65-ton converters available. Lining consists of 18-in burned chrome-magnesite brick. Tuyeres are punched mechanically, the installation on each converter comprising 46 automatically or man-



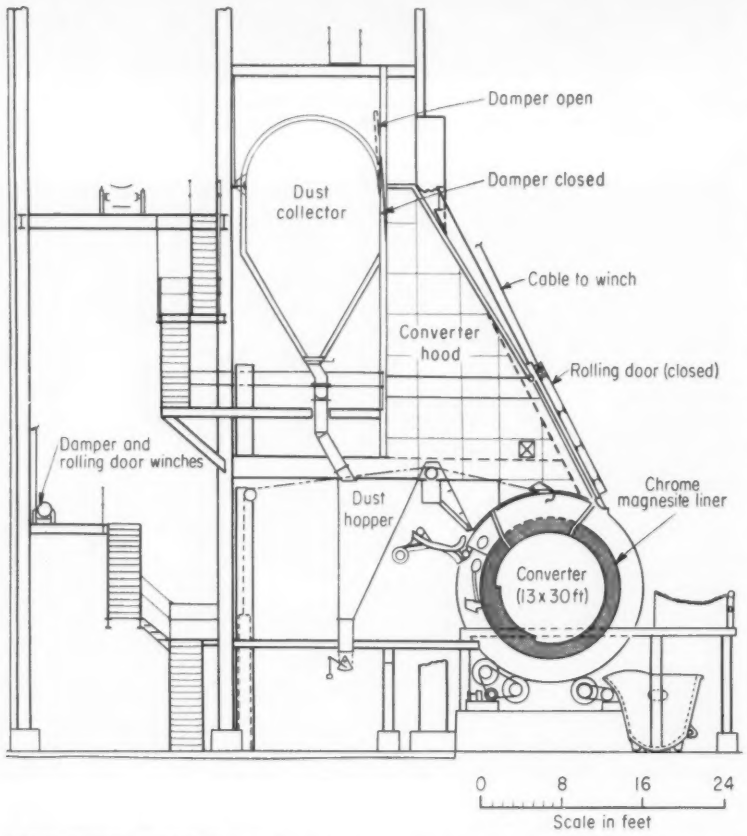
FEED BELT SYSTEM on top of the reverb feeds concentrates through 64 feed hoppers equipped with special slide gates. Design aids fettling and arch maintenance.

MATTE WILL BE FLOWING at a rate 40% above the current rate when the $40-million expansion is completed. Special raised roofs help hold temperatures down.

CONCENTRATE is handled in front of the smelter by the filter building, which includes a thickener for cyclone overflow.



THREE CYCLONES in the building send underflow direct to three disc filters. Control console guides the entire product flow.



CONVERTER DESIGN includes winches to move damper and rolling door, patterned after the simple freight elevator principle. A small hoist is employed.

ually controlled pneumatic punchers. Converter air at 15 psig and puncher air at 100 psig are delivered from the central power house. Converter operations are controlled from an operator's console at each converter. This includes the air supply which has alternate provision to control it remotely from the power house.

Other innovations found in the converter department include a spark shield which affords protection from falling sparks and provides ventilation for the punch operator; a system of hoisting the converter rolling door and flue damper patterned after the freight elevator principle, utilizing a relatively small electric hoist of standard design; vacuum cleaning system similar to that in the reverberatory section; and air-conditioned cabs on the two 60-ton overhead traveling cranes spanning the converter aisle. Silica flux is added to the converter by a conveyor belt discharging through the side of the uptake hood fitted with cast-iron liners.

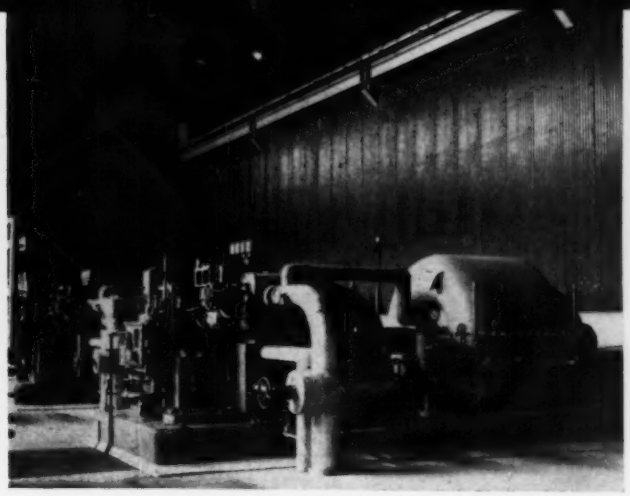
Anode Casting

Each of the two anode furnaces in which blister copper from the converters is treated by blowing with compressed air and by poling with green oak poles to remove excess oxygen and other waste materials, has a capacity of 250 tons. These are grouped around a conventional 32½-ft diameter casting wheel equipped with 22 copper molds. Casting rate is about 42 tph. An air-lift hoist transfers the anodes to bosh tanks, followed by removal to storage area by 15-ton overhead crane preparatory to loading into railroad cars for shipment to the refinery.

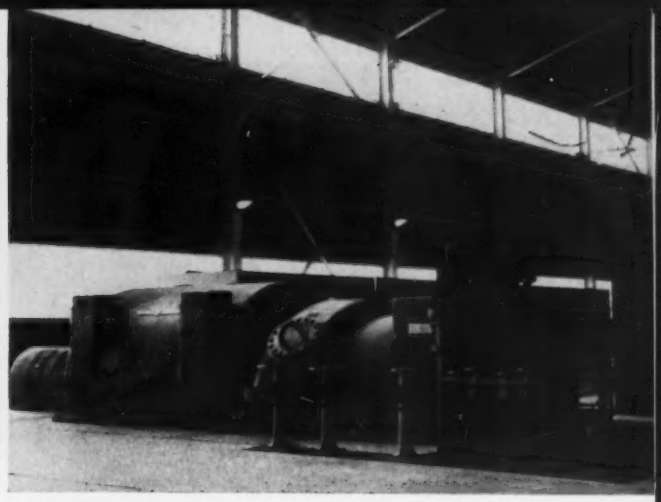
Reverberatory and converter waste heat gases are all combined prior to passing through a four-chamber, 60-gas duct, three-field type, electrostatic precipitator. Treated gases are exhausted through a 600-ft concrete stack lined with acid-resisting brick, with a 1½-in glass wool layer insulating the concrete from the brick lining. Dusts from the balloon-type flues and precipitator are collected by screw conveyors and delivered to a pug mill where they are moistened and later returned to the reverb charge by belt conveyor.

Power Plant

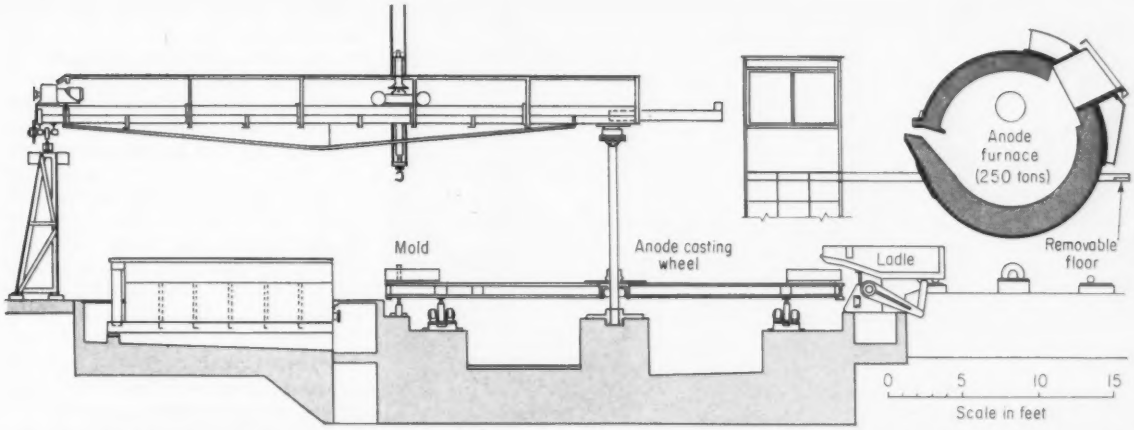
Principal air and power generating equipment installed in the model powerhouse includes a 9,375-kw steam turbine and three converter blowers, each rated 25,000 cfm air at 18 psig outlet pressure. They are of the three-stage centrifugal type driven by 1,970-hp straight condensing steam turbines running at 5,160 rpm. The



CONVERTER AIR is supplied by three stage blowers, each rated 25,000 cfm. Steam turbines are fed by waste heat.



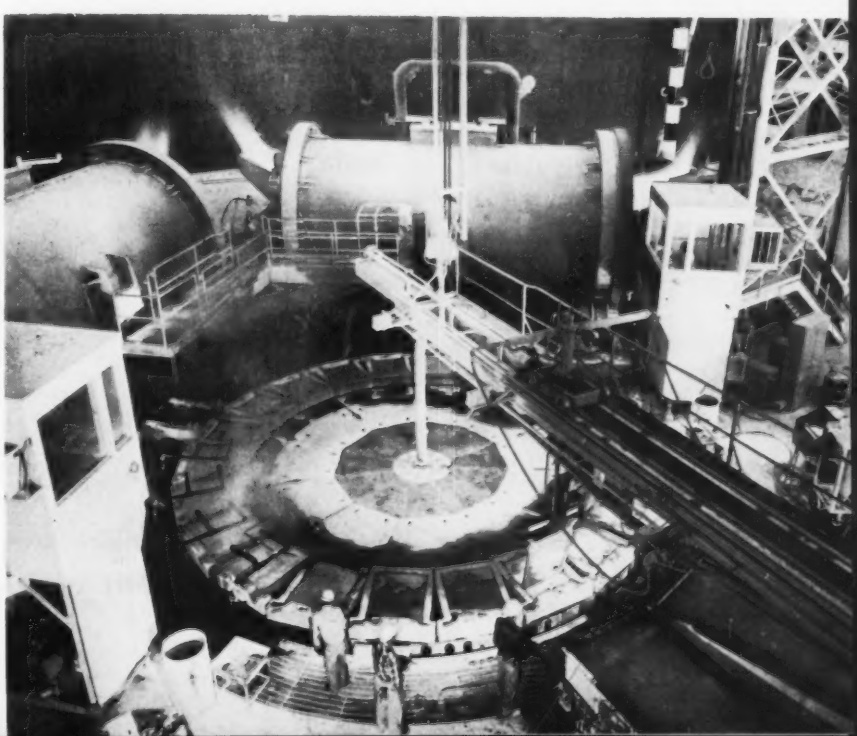
A 9,375-KW turbo generator unit in the smelter powerhouse provides the power for the blowers at 1,970 horsepower.



250-TON ANODE FURNACE are grouped around the ultra-modern casting wheel. Air lift hoist transfers anodes to the bosh tanks and a 15-ton crane places them in a storage area for eventual loading on railroad cars and shipment to Baltimore.

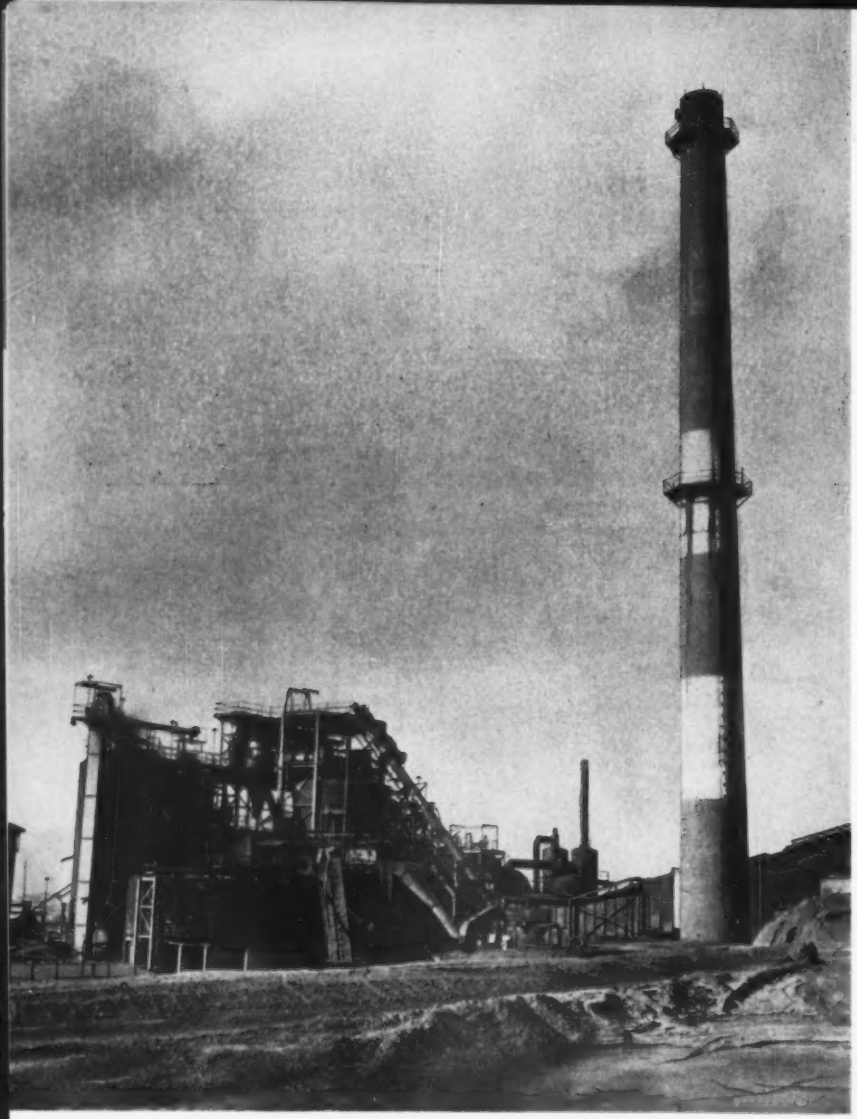
blower system is such that any of the three converters can receive air from any blower through the manifolding. The condenser serving the turbine generator has a capacity of 125,000 lb of steam per hour, and as a consequence can handle the normal steam output of the waste-heat reverb boilers, thereby permitting operation of the reverb when turbo generator is not in operation. High-pressure air for the converter tuyere punchers and general plant use is furnished by three 1000-cfm compressors. The powerhouse area is served by a 15-ton overhead crane.

The Ray Mines Division expansion involves enlarging the pit at Ray, construction of the new smelter at Hayden, and design and construction of the L-P-F plant at the smelter site. The L-P-F description follows.



ANODE CASTING CAPACITY is 42 tph on the 32½-ft wheel and its 22 molds.

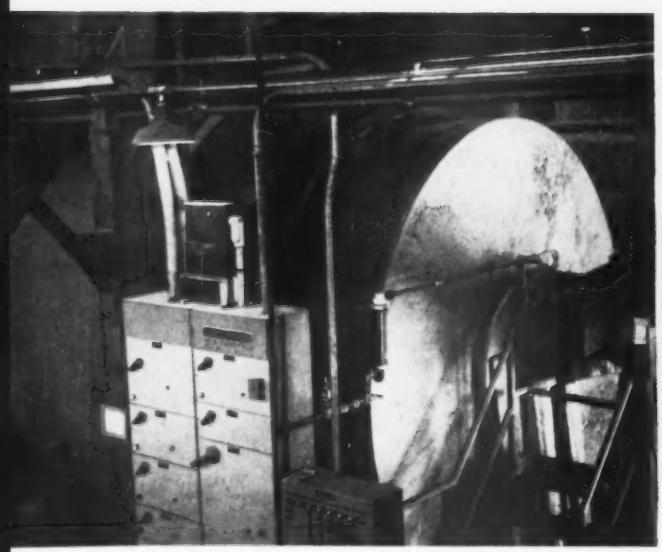
The L-P-F



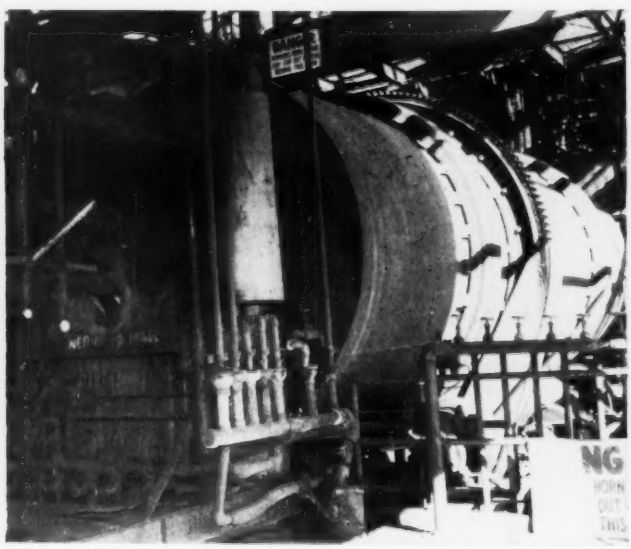
THE SCHIST-QUARTZ PORPHYRY-DIABASE ORES mined in the Ray pit contain significant amounts of non-sulphide minerals difficult to recover by conventional sulphide flotation alone. This applies especially to the schist and porphyry portions of the Hayden concentrator feed, in which about 20% of the copper occurs as copper silicates, cuprite, malachite, tenorite, and native copper. The chief copper mineral is chalcocite. The diabase material contains both chalcopyrite and large quantities of pyrite. Recovery of the non-sulphide copper values would mean higher over-all output of metallic copper, as well as a longer life for the Ray operations as a whole. This had been evident to the Kennecott management for some time. Funds were appropriated in 1953 to study the problem at its Research Center in Salt Lake City, Utah.

Laboratory tests and subsequent continuous pilot plant work carried out at the Center led to the development of the L-P-F process operated in the Hayden concentrator today. The plant as built by Western-Knapp Engineering Co. in 1955, represents a capital investment of $5-million. It is a fully integrated unit, producing its own sponge-iron and sulphuric acid required in the process from pyrite concentrate assaying about 40% iron and

THE SPONGE-IRON PLANT houses a FluoSolids reactor, Bruckner furnaces, Baker coolers and the screening plant.



MINUS 3-MESH SAND from the primary bowl classifier travels to 12x20-ft leaching diam. Pulp is from rod mill.



PYRITE CONCENTRATE from the FluoSolids reactor is converted into sponge-iron in the 30-ft brick-lined furnace.

Plant—Key to the New Hayden Smelter

36% plus sulphur removed from mill sulphide tailings by flotation. The economic production of these products is a distinctive feature of the Ray L-P-F process and in a large measure contributes to its success. Two years of large-scale operations have fully confirmed the findings of the initial pilot plant investigation. The process now provides for the recovery from Ray pit ore averaging 0.85% copper of about 2 lb additional copper per ton of mill feed.

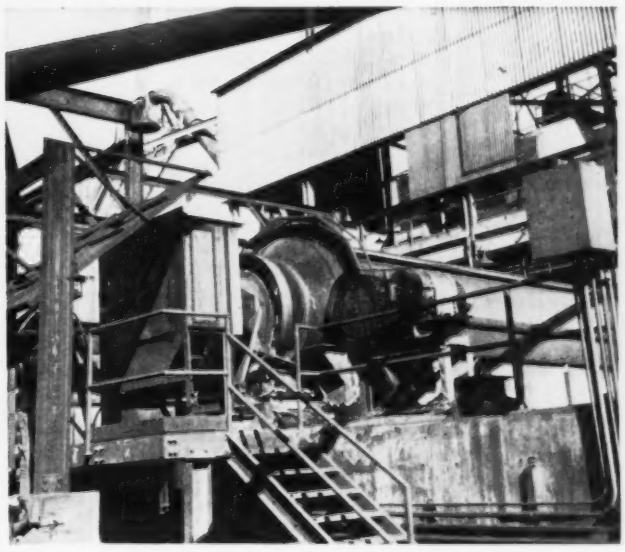
The L-P-F process is not new. The basic steps — namely, leaching non-sulphide copper minerals with sulphuric acid, precipitating the dissolved copper as metallic sponge, and recovering the sponge copper by flotation, have been known for years. The first successful application of the process was at Anaconda's concentrator at Anaconda, Mont., handling block-caved ore from the Greater Butte Project containing non-sulphide copper minerals (*E&MJ*, 1953, Vol. 154, p 90). Current L-P-F operations follow closely those proposed in the initial flowsheet. The basic metallurgy remains unchanged. Alterations made since 1955 were aimed at insuring a continuous operation and lower costs.

The principal plant units involved in the Ray L-P-F process include the leach-precipitation-flotation circuit housed in the concentrator proper and sponge-iron and acid plants near the smelter site. About 16,000 tpd of pit ore (to be increased to 22,500 tpd shortly) are treated in the concentrator today, of which about 4,000 tpd represents L-P-F feed. The ore, partially crushed at Ray, is ground to minus 3 mesh in 9x12-ft rod mills at the head of four parallel grinding-classifier circuits. As indicated in the accompanying flowsheet, L-P-F operations start at this point. Heads to the circuit range from 0.5 to 1.25 gpl of dissolved copper.

The rod mill discharge is separated into a minus 3-mesh sand fraction and a 3% plus 100-mesh, 8% plus 200-mesh slime fraction by primary bowl classifier and hydraulic cyclone. Classifier sands and cyclone underflow are leached in a 12x20-ft drum revolving at 4.32 rpm. Cyclone overflow goes to a 40-ft tank for leaching. Acid requirement averages 8 lb per ton of ore treated. About two-thirds of this is added at the leaching drum and the remaining one-third to the 40-ft leaching tank. Nominal retention time in the drum is 10 min. The leach solution in the drum is maintained at a pH of 1.5 to 1.7, and that in the leach tank at 2.0. Washing of the leached drum product takes place in rake-type classifiers in series, with the sands from the second classifier directed to the regular sulphide and pyrite section of the concentrator, and the overflow from the first classifier joining the cyclone overflow going to the leaching tank mentioned before.

Pulp from the 40-ft leaching tank containing from 18 to 23% solids is split equally and sent to four parallel precipitation, conditioning, and flotation sections. The precipitation, conditioning, rougher, and scavenger units are made up of 66-in. Fagergren cells and the cleaner and scalper machines of 56-in. Fagergren cells. Both virgin sponge-iron and that reclaimed from wet magnetic separators are added to the precipitation cells. Consumption per ton of ore treated is 8 lb. The conditioning units following the precipitation units receive Minerec-A and pine oil. Conditioned pulp is floated in rougher machines, with the resultant concentrate upgraded in cleaner cells. The cleaner concentrates composed of precipitated copper sponge and finely divided sulphide copper minerals are the final L-P-F product pumped to the smelter.

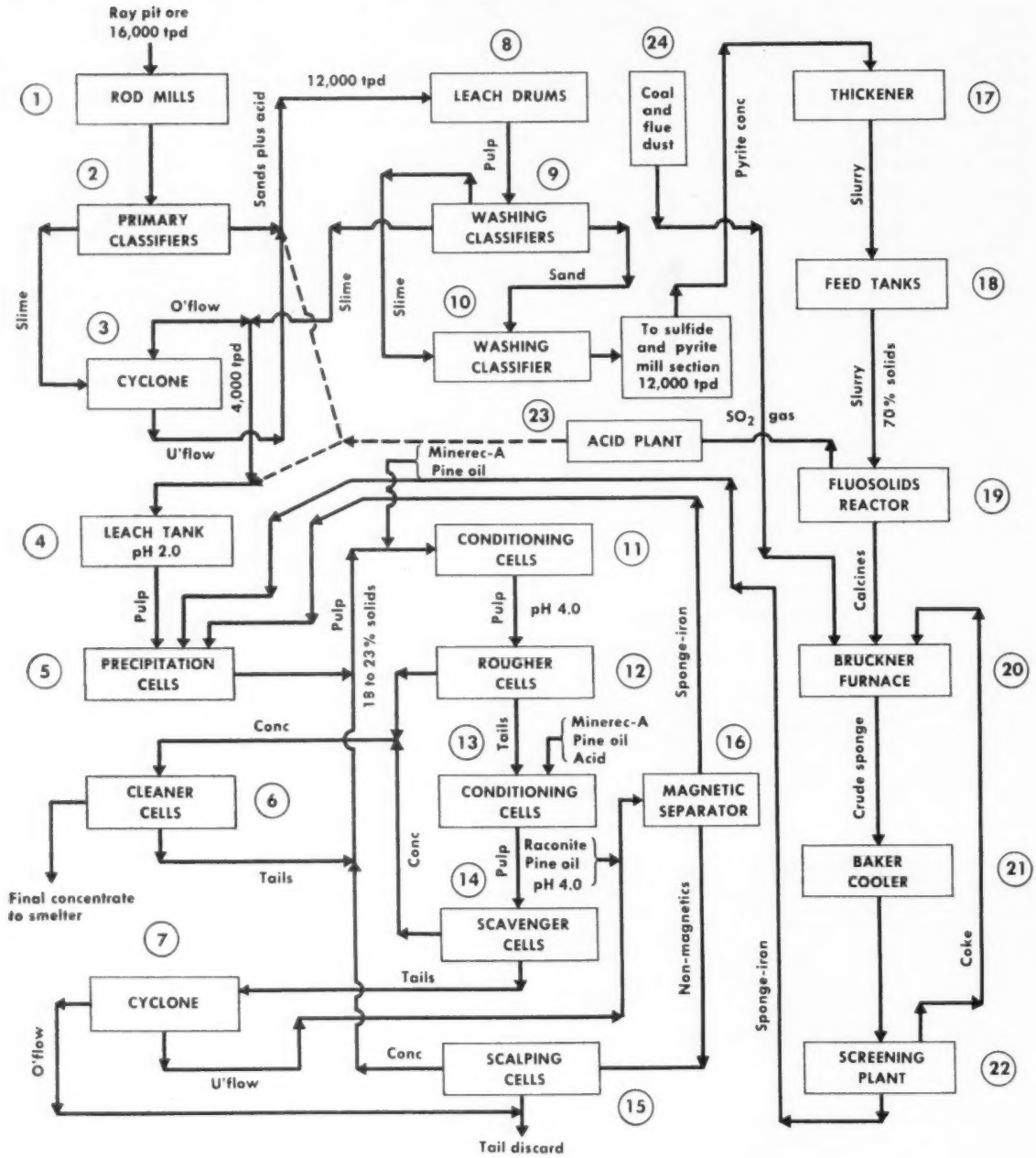
The cleaner tails are returned to the conditioners ahead of the roughers. Rougher tails, after treatment in second-stage conditioning cells receiving Minerec-A, pine oil, and additional acid go to scavenger cells. Concentrate produced by these units receive further treatment in the cleaners handling the rougher concentrates. The tails are pumped to a bank of cyclones where a slime discard is made, with the cyclone underflow being directed to a 36-in. wet magnetic separator. Magnetic material produced by that unit is fed back to the



HOT SPONGE-IRON from the furnace is carried to this 7x40-ft Baker cooler. Cooler rotates at 4 revolutions per minute.

SO_2 GASES generated in the Dorr FluoSolids reactor with the pyrites concentrate are converted in the contact acid plant.

Leach-Precipitation-Flotation Plant
Ray Mines Division, Kennecott Copper Corp.
Ray, Ariz.



Legend

1. Four 9x12-ft rod mills
2. Four 24-ft bowl classifiers
3. Four Krebs D-20B cyclones
4. 40-ft leach tank
5. Two Fagergren precipitators, nine 66 in. cells
6. Four Fagergren cleaners, four 56-in. cells
7. Six Krebs D-20B cyclones
8. Four 12x20-ft leach drums
9. Four 12-ft washing classifiers
10. Four 8-ft washing classifiers
11. Four Fagergren conditioners, four 66 in. cells
12. Four Fagergren roughers, eleven 66 in. cells
13. Four Fagergren conditioners, three 66 in. cells
14. Four Fagergren scavengers, nine 66 in. cells
15. One Fagergren scalper, five 56 in. cells
16. Two 36-in. Dings magnetic separators
17. 40-ft thickener
18. Two 12 feed tanks
19. Dorr Fluosolids reactor
20. 30-ft Bruckner furnace
21. 7x40-ft Bruckner furnace
22. Screening plant
23. 100-tpd contact acid plant
24. Coal and flue dust storage

precipitators and the non-magnetic pulp goes to a single set of scalper cells. Concentrate produced is returned to the conditioners ahead of the rougher machines and tails, along with the cyclone overflow, is discarded. Raconite, a crude butyl xanthate, and pine oil are added at the feed end of the scalper cells. A pH of 4.0 is maintained in the rougher and scavenging flotation circuits.

Plant operations are closely controlled at all times. With the amount of copper going to the L-P-F circuit not being constant, operators determine by hourly colorimetric assays the quantity of sponge-iron required and make necessary adjustments. Acid consumption is controlled by pH recorders and controllers installed ahead of the leach tank. Automatic sampling stations provide representative samples at critical stages in the circuit. Assays of the samples are used as a basis for metallurgical records and accounting.

The Sponge-Iron Plant

As mentioned previously, sponge-iron is produced from pyrite concentrate furnished by the concentrator. This material is pumped at 15 to 20% solids a distance of 1500 ft to a 40-ft thickener at the head of the sponge-iron plant composed of a FluoSolids reactor, two Bruckner furnaces with Baker coolers, and screening plant. Overflow from the thickener is returned to the concentrator. The underflow is pumped at 65 to 75% solids to one of two 12-ft air- and rake-agitated feed tanks equipped with feed guns. Only one tank is on the reactor feed cycle at a time, the other either being filled with slurry or having the valves on the feed gun so positioned as to recirculate the feed within the tank itself. The slurry is pumped into the reactor at 70% solids. During periods of excessive pyrite production, pyrite concentrate from the concentrator is directed to earthen ponds for storage. It is reclaimed when needed by mobile front-end loaders, treated in a modified pug mill, and pumped to either one of the feed tanks.

22-ft circular steel reactor is totally enclosed, brick-lined with inside walls 14 ft high. Air required for fluidization and for supporting the reaction of burning pyrite to iron calcines is furnished by a 300-hp blower. The air is introduced into the reactor through stainless-steel tuyeres with ⅛-in. holes drilled in the upper section and spaced at 10-in. intervals.

The furnace temperature is maintained at 1600 deg F. As the heating value of the oxidizing sulphur and iron in the pyrite usually is above that required to maintain reaction temperature, provision is made to remove any excess heat by vaporizing additional water for injection into the reactor via the feed guns.

The hot calcines or iron oxides leave the reactor by gravity through a bed overflow pipe. Gases and suspended solids are taken off the top of the reactor and after passing through two banks of hot cyclones either go to the near-by contact acid plant or to the main stack and atmosphere. The special seals installed at the base of each cyclone and in the bed overflow pipe permit the solids to pass while the gases flow to the acid plant or stack. Solids from the bed overflow and those recovered by the cyclones are mixed with coal preparatory to being fed via gravity feed pipes into a Bruckner furnace.

Here, reduction of the reactor calcines to metallic sponge-iron takes place at 1800 deg F following the reactions:

$$2C + O_2 \rightarrow 2CO$$
$$Fe_3O_4 + 4CO \rightarrow 3Fe + 4CO_2$$

Volatile material is driven from the coal and the mixture of coke and calcine is heated to 1800 deg F in the bed of the furnace. At this temperature the iron is reduced to the extent of 85 to 90% by carbon monoxide resulting from reaction between coke and carbon dioxide. The furnace resembles a short rotary kiln. It is 30 ft long, measures 8½ ft inside the high-heat-duty firebrick, and rotates at 1 rpm. The burners at the firing end use natural gas. Firing is countercurrent to the feed. Retention time within the furnace is about two hours. The precise and consistent optimum firing conditions followed by the furnace operators have reduced formation of rings, balls, and other large-size agglomerates to a minimum. No boring bar is maintained.

The hot reduced iron sponge is discharged by gravity through the firing hood of the Bruckner furnace and drops through a water-cooled chute into the Baker cooler. This is a cylindrical steel vessel cooled externally by water, measuring 7 ft in diameter and about 40 ft long, and rotating at 4 rpm. Both ends of the cooler are sealed to prevent air entry. The stationary seal at the feed end of the cooler is made from brake lining material. Inside the feed pipe there is a simple hinged flap valve which opens as the hot material passes. About 10 minutes are required to reduce the hot Bruckner furnace product to 150 deg F so that it can be discharged safely, without danger of reoxidation. Cooled sponge-iron leaves the cooler through an automatic mechanical port and is transported to the screening plant by a series of conveyors.

At the screening plant the cooled sponge-iron after passing over a steel grizzly is reduced to ¾ in. by a jaw crusher. The crusher product and grizzly undersize are then passed over a vibrating screen equipped with a 28-mesh deck, with undersize going direct to the product bins and the oversize to a dry magnetic separator for removal of unburned coal and coal char from the sponge-iron. The oversize magnetic material is ground in a 4x6-ft rod mill in closed circuit with the 28-mesh vibrating screen. Coal char is returned to the Bruckner furnace. Dust conditions are held down to a minimum by a dust collecting system serving the plant. Final sponge-iron is transported in a special truck to the storage bins at the concentrator. The screening plant also contains a surge bin capable of holding a 12-hr production of cooled, raw Bruckner furnace output. The sponge-iron plant described has a capacity of 30 tpd with one Bruckner furnace in operation and 60 tons with two furnaces.

Sulphur-bearing gases generated in the FluoSolids reactor are directed to the acid plant by a 200-hp low-pressure, variable-output centrifugal blower. The 100-tpd acid plant proper is a conventional "packaged" contact unit. It uses a combination of water impingement and spray tower, mist Cottrell, and a drying tower to clean gases. In addition to absorption towers and heat exchangers, there is a converter tower containing vanadium pentoxide as the catalyst. The correct amount of oxygen input as well as temperature regulation of this unit is effected by chain-operated valves. Storage facilities available consist of two steel tanks, each capable of holding 750 tons of acid. Transfer to mill storage is via pipe line.

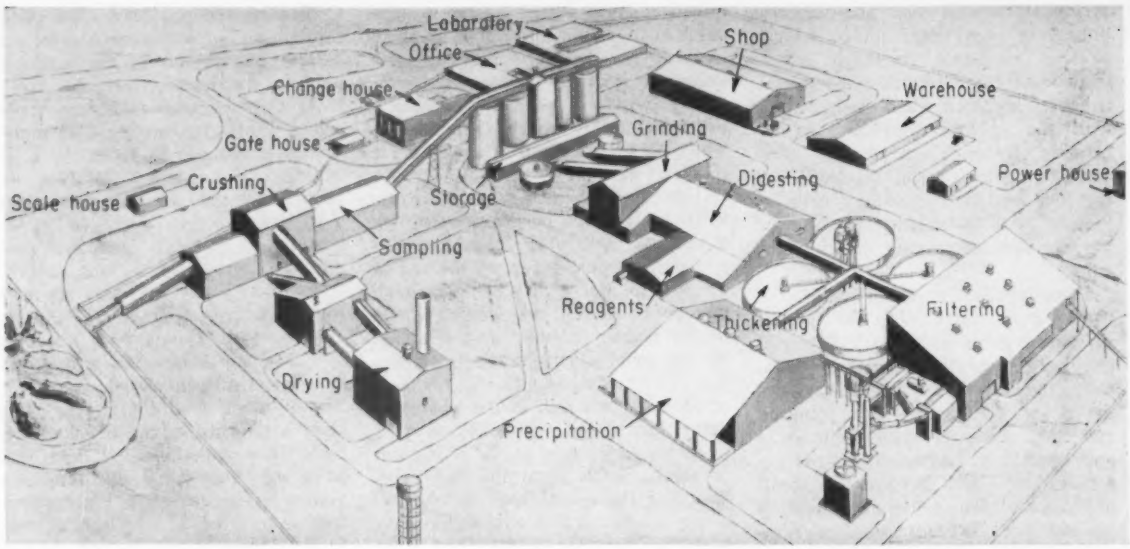
The Pit Extension

The pit extension already underway will necessitate removal of 45 buildings in Sonora and Barcelona this year and evacuation of the entire business district in Ray within five years.

It will require relocation of the general shop area including machine shop, boiler shop, car repair shop, electrical shop and warehouse.

Before end of the year, some 37 buildings will have to be removed from their present sites, since they lie within the 220 ft safety zone at the planned pit expansion.

Some merchants already have announced plans to open stores in the new town of Kearny, 12 miles south of Ray.



HOMESTAKE-SAPIN PARTNERS has applied instrumentation and automatic controls to the Ambrosia Lake uranium leach plant to give the operators continuous data on process and equipment, and to effect more uniform process control.

Instruments Automate New Mexico Mill

E. S. ALLEN
E. A. MALMBERG
W. G. HANSEN

BECAUSE OF THE NEWNESS of the uranium industry and because of the choice of variables which exist, there is no traditional approach to process control. Keen competition within the industry has made some of the more progressive plant managers aware of the tremendous advantages that may be achieved through proper application of instrumentation and controls. For example, in the Homestake-Sapin Partners uranium mill near Grants, N.M. automatic process control is employed to a degree never before achieved in the mining industry.

The recovery of uranium oxide (yellow cake) from ores must be considered a relatively new process. However, uranium metallurgy is quite similar to the recovery of gold by the cyanide method. In each case the valuable mineral or metal is crushed, sampled, ground sufficient to free the mineral, and the valuable mineral or metal dissolved in a water chemical solution, liquid-solid separation, precipitation and packaging of the valuable product, waste disposal of the leached ore, etc.

E. S. Allen is mill manager, Homestake-Sapin Partners; E. A. Malmberg is instrument design engineer, Utah Construction Co.; W. G. Hansen is instrument maintenance foreman, Homestake-Sapin Partners.

Basically there are two methods which are popularly employed to dissolve the uranium, namely sodium carbonate-sodium bicarbonate leach, and sulfuric acid leach. There are more methods employed in effecting the liquid-solid separation, such as filtering countercurrent decantation, resin-in-pulp, solvent extraction (this is not normally used, however, as a liquid-solid separation step) etc.

In either of the two dissolution methods there are many operating controls that affect recovery including:

a) Chemical concentration
b) Pulp density during dissolution
c) Temperature of pulp during dissolution
d) Oxidants to oxidize the tetravalent uranium minerals to the hexavalent state during dissolution.

Instrumentation and automatic controls are applied in a plant for one or more of the following reasons:

1. To give operators continuous information concerning process conditions and changes.

2. To alert operators to off-normal process conditions as they are experienced and thus allow corrective action to be taken before serious upsets occur.

3. To effect better, more uniform process control than is possible by operator hand control in order to insure uniform quality products.

4. To reduce operator workload, and hence, reduce plant operator and labor force requirements.

In a plant with minimum instrumentation and controls, the first and possibly the second reasons listed above might have been considered. In the Homestake-Sapin Partners mill, however, Utah Construction Co. engineers, who were the designers and builders, were asked to design for maximum utilization of a minimum operator and labor force. Consideration had to be given to all four of the reasons listed above.

The host rock in which the uranium occurs is a sandstone which contains approximately 85% SiO_2. Instruments operating in a slurry of solutions and the ground sandstone would have to be rugged and located to reduce abrasion and corrosion, yet still provide the control and signal that could be depended upon.

To simplify maintenance and parts inventories (and also to train operators more easily) conventional, standard instruments were specified in almost all instances. However, to achieve the required process control, it was necessary to make some not so conventional applications of the instruments.

The plant was designed to process

1,500 tpd of uranium sandstone ores and was divided into nine processing areas plus waste disposal area, namely (1) crushing, (2) sampling, (3) grinding and classification, (4) thickening and digestion, (5) thickening and filtering, (6) steam generation and recarbonation, (7) precipitation, drying and packaging, (8) reagents preparation, storage and feeding, (9) power generation plant.

In each of the first seven areas, operation of all processing equipment is from a local integrated control. Process controls and electrical controls have been integrated into a logical arrangement specially designed for operational facility. No central control panels were designed for the last two areas because these systems would be unduly complicated by attempted centralization of controls. Here, however, as through the remainder of the plant, automatic controls are judiciously employed most effectively to reduce the operator workload and assure constant uniform operation.

In selecting the instruments all of the above considerations as well as reliability, delivery, cost, etc. were evaluated.

All the features of Homestake-Sapin Partners mill control and instrumentation are numbered from 1 to 31 on the flowsheet. These reference numbers are shown in parenthesis in the text as a quick guide to the area of the flowsheet being discussed.

Following crushing and screening of the crushed ore to 100% minus ½ in., the primary sample is cut from the main ore feed to the plant by a Galigher Co. automatic sampler (1 and 2). The sample cuts are all 10% of the feed to the sampler and a much more uniform and representative sample than could be obtained by hand sampling.

A surge hopper mounted on bearings and a Taylor volumetric load cell and transmitter provide, through a recording controller (3), a constant record of the weight of the sample cut.

The controller (3 and 4) pneumatically and automatically regulates the speeds of the sampling system conveyors through the Reeves Varispeed drives to enable the sampling system to adjust itself automatically to variable plant ore feed rates. Automatic-to-manual loading stations (5 and 6) on the control panel enables the operator to clear the surge hoppers rapidly at the conclusion of crushing a "lot" of ore or to juggle the sampling load within the system long enough to relieve a plugged chute and so avoid spillages. The system maintains uniformly loaded conveyor belts between the sampling steps.

The purpose of the grinding circuits is to prepare the ore for subsequent processing. The minerals must be liberated for extraction and the ore must be sized for material handling in the liquid-solid separation. Feed to the grinding circuits is controlled by two belt scales (7) constantly measuring the fine ore feed to the ball mills and these weights are recorded automatically on two recording controllers. Once the operator has set the feed rate on the controller the instrument will act to maintain feed automatically by pneumatic regulation of the speeds of the feeder conveyors from the fine ore bins through pneumatic positioning of the Reeves Varispeed drives on the feeders.

Again, automatic-to-manual loading stations enable the operator to take over in the event of severe upset or during process startup, etc. The controls are so arranged that blending of ores from two different bins may be accomplished very easily without any equipment modifications.

The ore is ground in the ball mills and the classification of the particle size is made in the sodium carbonate-sodium bicarbonate mill solution. The mill solution is pumped to a float-valve-controlled steady head tank in the grinding bay. Since the weight of feed is constantly controlled and recorded together with the constant mill solution pressure from the steady head tank, no other automatic controls were deemed justified.

To Give Continuous Information

After the circuit has been manually set as to densities by the operator there is seldom any requirement for changes in the circuit. Particle size control is through the classifier density weir overflow.

Classifier overflow is pumped to a pulp-to-pulp heat exchanger where the waste heat from digestion is recovered in a condenser type, alumina brick lined vessel. The "cold" classifier overflow-pulp goes into one of two 100 ft dia thickeners for density control of the digester feed. The clear solution overflowing the thickener goes to the mill solution storage tank for use in the grinding circuit.

The thickener underflow is thickened to a density of 1500 to 1530 grams per liter. The thickener drive mechanism is equipped with a torque indicator (10), transmitter and recorder to give the operator knowledge as to the thickener loading. The torque indicator is also equipped with a warning horn when the torque reaches 65% and a cut-out when the torque reaches 95%.

Extraction or dissolution of uranium from the ores is greatly accelerated in the presence of heat. The uranium minerals to be soluble in sodium carbonate must be in the hexavalent valence. The digester circuits are designed for the control of the heat additions and for the oxidation of the tetravalent uranium minerals to the hexavalent state.

To Alert the Operators

The digesters are vertical autoclaves equipped with steam coils, bubble caps for the introduction of compressed air, agitation mechanisms to effect good heat exchange and to disperse the compressed air and to keep the pulp in uniform suspension. The vessels are fabricated to maintain the top dome of compressed air up to a pressure of 97 psig to increase the partial oxygen pressure in the vessel.

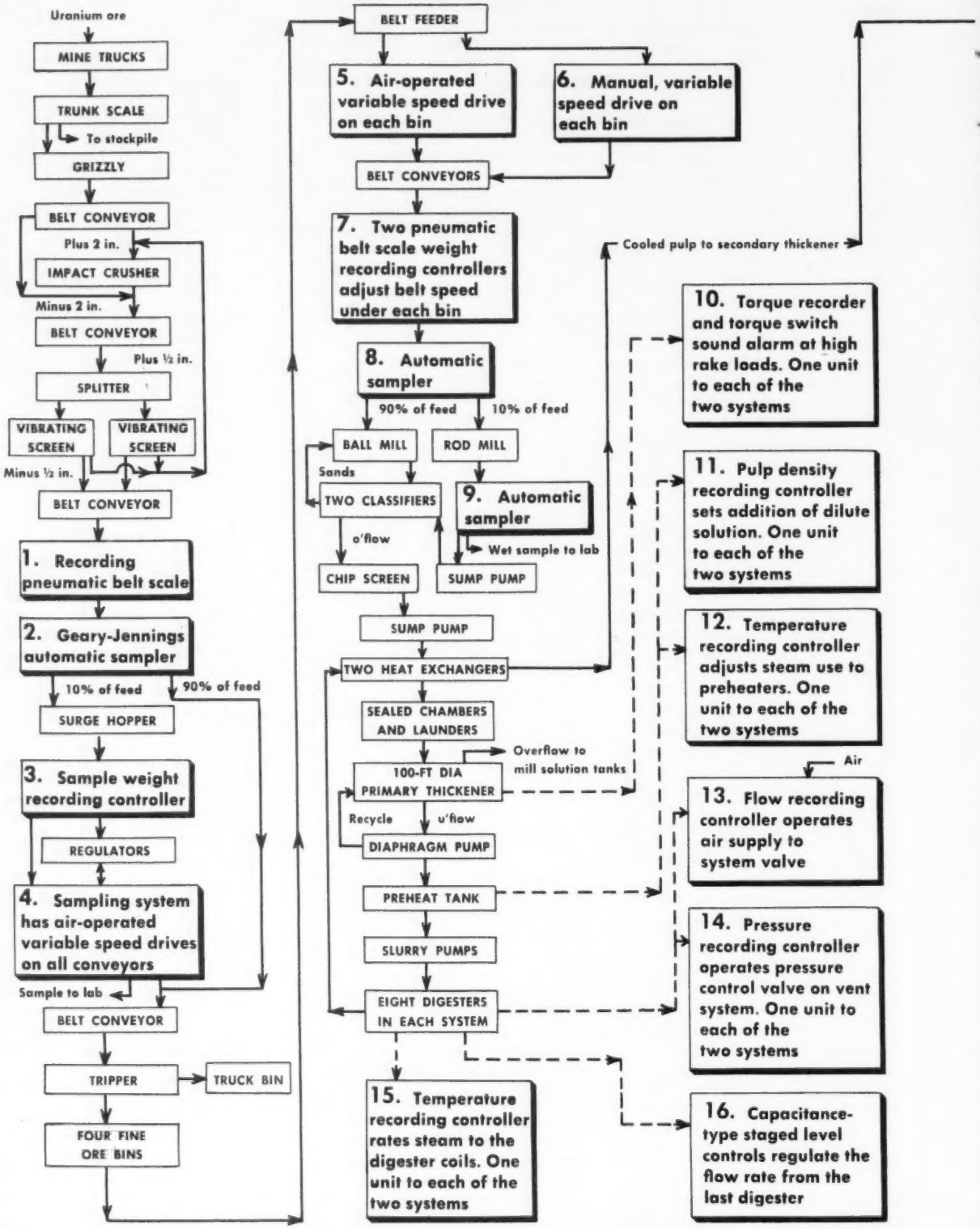
Process heating in the digesters is controlled automatically (12 and 15) from the digester control panel by Taylor instruments. Air introduction rate into the vessels is controlled automatically (13) as well as the regulation of the pressure (14) in the system by automatic control of the The tanks were installed with a 6-in. venting rate from the domes. There are eight digester vessels per circuit. step down between each succeeding tank—adequate for the pressure drop between vessels. The final digester in each circuit is discharged to the pulp-to-pulp heat exchanger.

The pulp level (16) in the final digester controls the discharge rate. This is accomplished by the use of three electronic capacitance type probes, each set for a different level. As the level rises in the final digester, first one, then two, and finally three feed valves to the pulp-to-pulp exchanger are opened. In addition to the three control probes there is an additional probe set at a pulp level six inches higher than the high control probe. The fourth probe is a high-high warning to the operator in case of stuck valves, etc.

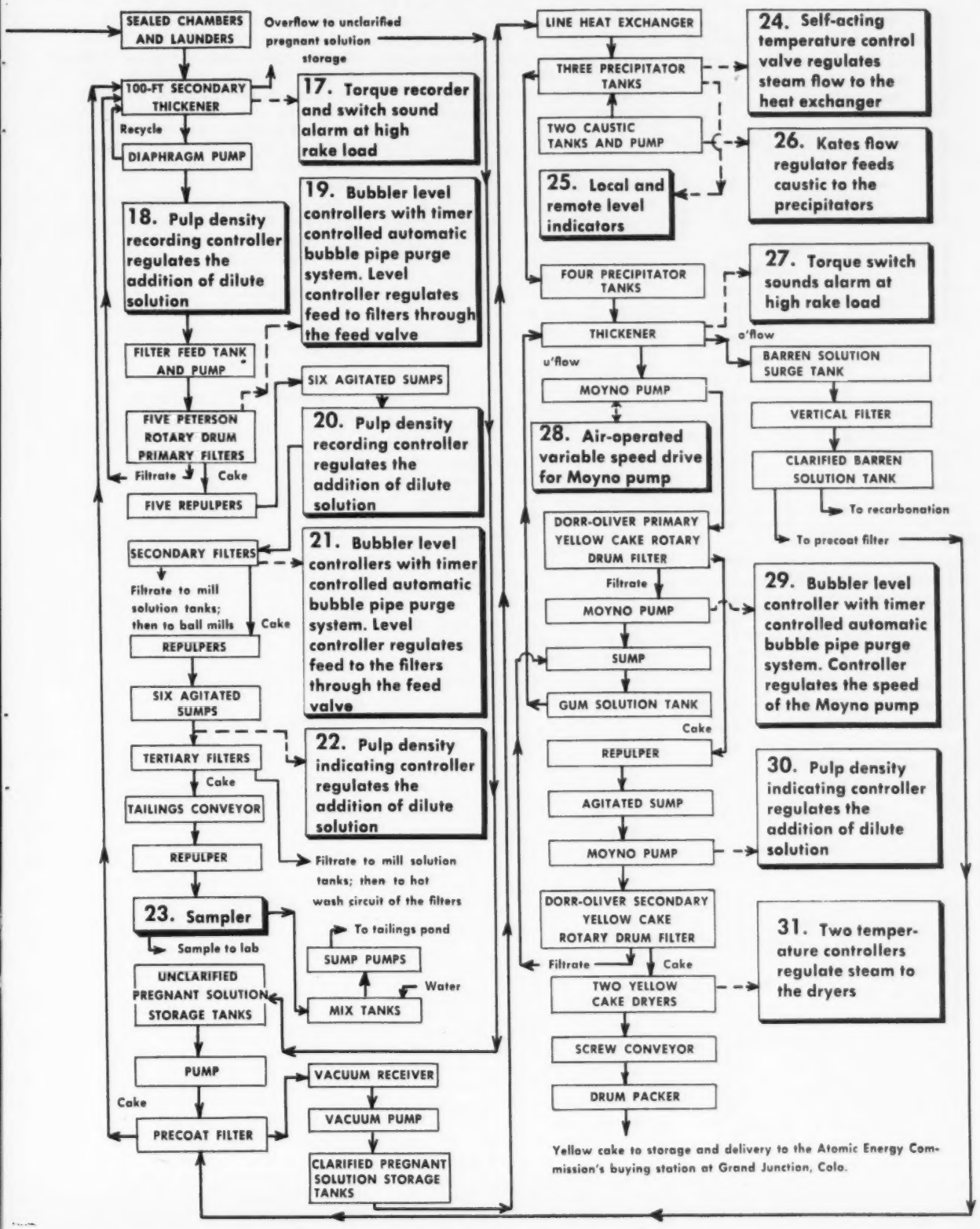
System pressure is adequate to move the hot pulp through the exchanger at a rate commensurate with the rate of use in level within the digester, or in other words, the flow rate through the digesters.

Pulp density changes (18) of the

Uranium Flowsheet
Homestake-Sapin Partners
Grants, N. M.


Uranium ore
MINE TRUCKS
TRUNK SCALE
To stockpile
GRIZZLY
BELT CONVEYOR
Plus 2 in.
IMPACT CRUSHER
Minus 2 in.
BELT CONVEYOR
Plus ½ in.
SPLITTER
VIBRATING SCREEN
VIBRATING SCREEN
Minus ½ in.
BELT CONVEYOR
1. Recording pneumatic belt scale
2. Geary-Jennings automatic sampler
10% of feed
90% of feed
SURGE HOPPER
3. Sample weight recording controller
REGULATORS
4. Sampling system has air-operated variable speed drives on all conveyors
Sample to lab
BELT CONVEYOR
TRIPPER
TRUCK BIN
FOUR FINE ORE BINS
BELT FEEDER
5. Air-operated variable speed drive on each bin
6. Manual, variable speed drive on each bin
BELT CONVEYORS
7. Two pneumatic belt scale weight recording controllers adjust belt speed under each bin
8. Automatic sampler
90% of feed
10% of feed
BALL MILL
ROD MILL
Sands
TWO CLASSIFIERS
9. Automatic sampler
Wet sample to lab
o'flow
CHIP SCREEN
SUMP PUMP
SUMP PUMP
TWO HEAT EXCHANGERS
SEALED CHAMBERS AND LAUNDERS
Overflow to mill solution tanks
100-FT DIA PRIMARY THICKENER
Recycle
u'flow
DIAPHRAGM PUMP
PREHEAT TANK
SLURRY PUMPS
EIGHT DIGESTERS IN EACH SYSTEM
15. Temperature recording controller rates steam to the digester coils. One unit to each of the two systems
Cooled pulp to secondary thickener
10. Torque recorder and torque switch sound alarm at high rake loads. One unit to each of the two systems
11. Pulp density recording controller sets addition of dilute solution. One unit to each of the two systems
12. Temperature recording controller adjusts steam use to preheaters. One unit to each of the two systems
Air
13. Flow recording controller operates air supply to system valve
14. Pressure recording controller operates pressure control valve on vent system. One unit to each of the two systems
16. Capacitance-type staged level controls regulate the flow rate from the last digester

Instruments Guide and Control Process Flow


SEALED CHAMBERS AND LAUNDERS
Overflow to unclarified pregnant solution storage
100-FT SECONDARY THICKENER
17. Torque recorder and switch sound alarm at high rake load
Recycle
DIAPHRAGM PUMP
18. Pulp density recording controller regulates the addition of dilute solution
19. Bubbler level controllers with timer controlled automatic bubble pipe purge system. Level controller regulates feed to filters through the feed valve
FILTER FEED TANK AND PUMP
SIX AGITATED SUMPS
FIVE PETERSON ROTARY DRUM PRIMARY FILTERS
20. Pulp density recording controller regulates the addition of dilute solution
Filtrate
Cake
FIVE REPULPERS
SECONDARY FILTERS
21. Bubbler level controllers with timer controlled automatic bubble pipe purge system. Level controller regulates feed to the filters through the feed valve
Filtrate to mill solution tanks; then to ball mills
Cake
REPULPERS
SIX AGITATED SUMPS
TERTIARY FILTERS
22. Pulp density indicating controller regulates the addition of dilute solution
Cake
TAILINGS CONVEYOR
REPULPER
Filtrate to mill solution tanks; then to hot wash circuit of the filters
23. Sampler
To tailings pond
Sample to lab
SUMP PUMPS
Water
UNCLARIFIED PREGNANT SOLUTION STORAGE TANKS
MIX TANKS
PUMP
VACUUM RECEIVER
Cake
VACUUM PUMP
PRECOAT FILTER
CLARIFIED PREGNANT SOLUTION STORAGE TANKS
LINE HEAT EXCHANGER
24. Self-acting temperature control valve regulates steam flow to the heat exchanger
THREE PRECIPITATOR TANKS
TWO CAUSTIC TANKS AND PUMP
26. Kates flow regulator feeds caustic to the precipitators
25. Local and remote level indicators
FOUR PRECIPITATOR TANKS
27. Torque switch sounds alarm at high rake load
THICKENER
o'flow
BARREN SOLUTION SURGE TANK
u'flow
MOYNO PUMP
VERTICAL FILTER
28. Air-operated variable speed drive for Moyno pump
CLARIFIED BARREN SOLUTION TANK
To recarbonation
To precoat filter
DORR-OLIVER PRIMARY YELLOW CAKE ROTARY DRUM FILTER
Filtrate
29. Bubbler level controller with timer controlled automatic bubble pipe purge system. Controller regulates the speed of the Moyno pump
MOYNO PUMP
SUMP
GUM SOLUTION TANK
Cake
REPULPER
30. Pulp density indicating controller regulates the addition of dilute solution
AGITATED SUMP
MOYNO PUMP
DORR-OLIVER SECONDARY YELLOW CAKE ROTARY DRUM FILTER
Filtrate
Cake
31. Two temperature controllers regulate steam to the dryers
TWO YELLOW CAKE DRYERS
SCREW CONVEYOR
DRUM PACKER
Yellow cake to storage and delivery to the Atomic Energy Commission's buying station at Grand Junction, Colo.

feed to the digesters are determined by a unique but simple arrangement of measurement of the change in static head of a column of slurry of constant height. Sufficient flow velocity is maintained in the slurry column to insure a constant upward movement of all suspended material in the stream. Thus, any change in liquid head registered by the diaphragm pressure transmitter at the base of the column is directly proportional to density change.

To Reduce Operator Workload

Careful design of the system to eliminate dead pockets kept silt buildup to a minimum and made the system virtually self-cleaning. This density measurement is then fed through a controller (19) to regulate the addition of diluent solution to the slurry feed to the digesters. The same signal could also be utilized to increase or decrease the flow rate through a pneumatic controlled vari-speed drive on the thickener underflow pump.

Since the shift foreman spends much of his time in the digester building, provision was made on the digester control panel for emergency stop of all equipment in both the grinding and digester circuits. Start-up of grinding circuit equipment, however, must be accomplished from the grinding control panel. This feature was included to protect personnel and equipment.

The thickening and filtration section of the plant is the liquid-solid separation portion of the plant. In order for the plant as a whole to operate most efficiently, the filters must operate at optimum efficiency. Vacuum drum filters are extremely sensitive to density and pulp level of the feed in the agitated tubs. The digested pulp is thickened in two secondary thickeners identical to the two primary thickeners as described above.

The duty of the secondary thickeners is to provide density control of the filter feed. The underflow is pumped with density control similar to the control provided for the digester feed.

The filter system consists of three stages of filters with repulpers and agitated sumps between filtering stages. Each stage of filters consists of five Peterson Filters & Engineering Co. continuous vacuum drum type, 11½ ft dia x 18 ft long. The filter cake from the first bank is repulped with sufficient solution to make it sufficiently fluid to flow by gravity to an agitated sump between two stages of filters. Gravity flow through the three stages of filters eliminates many expensive pumping and maintenance problems.

The repulping between stages has been designed to permit shutdown of any filter in any stage without materially affecting the operating of the previous or subsequent filtering stage. This is an excellent example of how the alertness and coordination of the design and instrument engineers apply standard equipment and instruments to solve special problems. The repulped filter cake from two adjacent filters in the first bank, for example, is divided from each repulper and the two divided portions are combined in an agitated sump between the first and second banks. From this point, after adjustment of density, the slurry flow is proportionally divided to become the feed to two adjacent filters in the second bank.

In the agitated sump, the pulp density (20) changes are determined by measurement of the change in static head of a column of slurry of constant height. A diaphragm type pressure transmitter attached to a specially designed but simple watertight mounting is immersed in the slurry with the diaphragm face down to prevent silt deposition on the transmitter face. A constant slurry height is maintained over the diaphragm by a simple overflow weir arrangement. Agitation is provided in the vessel by a turbine type mixer to maintain the solids in a suspension of uniform density and serves to keep the diaphragm face clean at all times.

To Effect Better Quality Control

Thus any change in pressure sensed by the immersed diaphragm transmitter is directly proportional to density change. The density signal is fed through a controller (21) to regulate the addition of diluent solution to the agitated sumps to bring the slurry to optimum consistency for filter feed.

The level in the filters is measured by a bubble-tube arrangement (21) with a unique time-controlled automatic purging system. Addition of even relatively small amounts of water to the filters could upset the water balance in the filter system after the densities of the feed streams have been adjusted. Therefore, the purge system was designed to operate with negligible quantities of water under pressure to give the effect of a regular periodic hydraulic ram to clean out the bubble pipe. In all three stages of filters, the feed rate to the filters is regulated by the level of the pulp in the filter tubs.

In the second and third stages, however, the feed is proportioned automatically to adjacent filters according to each individual demand. Thus if one filter is blinding and filtering rate is low, the excess load of that filter automatically is proportionally spread over the other filters in the stage. High level alarms on the filters alert the operators of off-normal conditions with sufficient time to take corrective action before spillages occur.

Temperatures of the diluent solutions and filter wash solutions are also controlled automatically.

Although there is no recycle provision in the filter circuit, the system is so designed that a filter may be taken off stream for cleaning or filter cloth replacement with very little reduction in output.

Positive Filter Control

In the filter circuit, judiciously selected automatic controls and equipment arrangement enable three men per shift to operate the 15 large filters, three vacuum pumps, a precoat filter, two 33,000 lb per hour boilers and the auxiliary equipment.

The two boilers, which supply all of the process steam requirements for the plant, are equipped with conventional controls and conventional safety features. Normally gas fired, they may be oil fired in emergency with manual switch-over.

The recarbonation circuit is a reagent saving installation whereby carbon dioxide contained in the boiler flue gas is used as a reagent in the form of sodium bicarbonate in the filter circuit washes and the extraction process. In the dissolution of uranium the following relations are involved:

Uranium dissolution

$$UO_3 + 3CO_3 = + H_2O \rightleftarrows UO_2(CO_3)_3\equiv + 2OH^-$$

$$UO_2 + \tfrac{1}{2}O_2 + 3CO_3 = + H_2O \leftrightarrows UO_2(CO_3)_3\equiv + 2OH^-$$

$$OH^- + HCO_3^- \rightarrow CO_3 + H_2O$$

Uranium precipitation

$$HCO_3^- + OH^- \rightarrow CO_3 + H_2O$$

$$UO_2(CO_3)_3\equiv + 4OH^- + 2Na^+ \rightarrow Na_2UO_4 + 3CO_3^= + 2H_2O$$

$$2UO_2(CO_3)_3\equiv + 6OH^- + 2Na^+ \rightarrow Na_2U_2O_7 + 6CO_3^= + 3H_2O$$

Thus it may be seen that sodium bicarbonate is necessary to dissolve uranium minerals and the bicarbonate must be neutralized to precipitate sodium diuranate. The barren solution resulting from the precipitation

is recarbonated for re-use with boiler flue gas.

In setting up conditions for the recarbonation, an automatic damper control on the stack insures a slight positive pressure in the stack to prevent dilution of stack gases with air and to prevent condensation and stack corrosion from atmospheric down drafts.

The boilers are equipped with economizers to control the temperature of the boiler flue gases for most efficient utilization of the gases in the recarbonation. The boiler feed water to the economizers is controlled by the exit gas temperature through transmitters and controllers on the water feed. Boiler feed water not used to control gas temperature goes directly to the boiler steam drum.

Local gas and liquid flow gages, panel mounted tank level gages, and automatic liquid level control in the recarbonation towers enable the operator with minimum effort to maintain effective balance and control in the recarbonation circuit.

In the precipitation circuit the uranium is precipitated (see chemical equations above) with sodium hydroxide as a 50% solution. The precipitate is sodium diuranate (yellow cake) and precipitated from the clarified pregnant solution which overflows the secondary thickener and is clarified through a precoat filter with expanded perlite as a filtering media.

Automatic Caustic Feed

Based on the pregnant liquor flow rate as recorded and controlled on the precipitation control panel and bicarbonate analysis data, the operator sets a Kates flow regulator which automatically maintains the required caustic flow rate regardless of upstream or downstream pressure fluctuations.

Following the precipitation step, the yellow cake slurry flows into a 40 ft dia thickener where the yellow cake settles and the overflow (caustic barren solution) is pumped through pressure polishing filters.

The 40 ft thickener underflow becomes feed to the product filters. Automatic regulation of the feed to the product filter is accomplished by level control in the primary filter which regulates the speed of the filter feed pump through a pneumatic controlled Reeves Varispeed drive. Here again, the same unique purge system (29) for the bubble pipes as used in the filter circuit assures constant accurate level control. Automatic control of density of the repulped yellow cake to the second stage product filtration is accomplished in the same manner as in the filtration circuit. This assures optimum filtration rates and a feed stream to the product dryer of uniform moisture content. Thus with automatic temperature control (31) in the product dryer, a uniform product is assured.

The Homestake-Sapin Partners mill was designed and partially constructed before any mine shafts had penetrated the ore zones, approximately 750 ft deep. All metallurgical testing had been performed on core samples by drilling. Engineering and design were aware that the sandstone formation containing the ore zones contained water under pressure. It was considered likely that the orebodies would be wet and the ore well might require drying for ease in material handling and to reduce dilution of the sodium carbonate solution.

Mine Ore Is Dried

With foreknowledge of the possible requirement of an ore dryer, the crushing plant was designed to provide certain elevations and adequate ground space requirements. In May 1958, when the construction of the plant was approximately 80% complete, the mine shafts had been completed and sufficient mine development work had shown that the ore would contain considerable moisture, in the range of 15 to 18% by weight, and a dryer installation would be advisable if not a necessity.

Even though design and engineering work had started on the installation, sufficient previous thinking had provided equipment sizes and other basic items to cover such an eventuality. It was also decided to instrumentize the dryer installation so that no additional operating manpower requirements would be necessary.

The dryer was a Stearns Roger Mfg. Co. 10 ft dia x 80 ft long rotary dryer with lifting bars and feed scrolls inside the dryer. The air heater chosen was Coen air heater of 70-million Btu/hr capacity for either natural gas or fuel oil firing. The dust collectors chosen were American Air Filter Co. Rotoclones Type W of 45,000 cfm—two fans.

The basic specifications for instrumentation were set out as follows:

1. The natural gas consumption of the air heater should record both flow rate and totalize the flow. Since the retention time in the dryer approximates 20 minutes, the operator should be advised as to the response of the instruments to the rate of ore feed to the dryer.

2. The dryer drive should be variable speed so that when ores of lower moisture content were being fed, the throughput of the dryer could be increased. This was accomplished with a wound rotor motor with manual step control.

3. The dryer exit gas temperature would primarily control the air heater firing rate with the dryer product temperature being recorded to override the former in case the product temperature should endanger the conveyor.

4. The air heater combustion chamber should be maintained at a negative pressure at all times to protect the air heater burner and to protect the refractory in the combustion chamber.

5. The temperature of the exit gases from the combustion chamber should be recorded and should control the introduction of secondary air to keep the refractory temperature within operating range of the refractory.

Through excellent cooperation of the Coen Co. and Taylor Instruments, Inc. the controls and instrumentation were coordinated in a package deal for the air heater, instruments, control panel and an annunciator panel. The controls of the airheater are pneumatic. The Rotoclone fans are started by draft control and the water spray supply incorporates a pressure switch for low pressure cut-out and a flow switch for low flow rate cut-out. The dryer drive motor has an indicating ammeter at the panel and a recording ammeter at the crusher operator station, located approximately 250 ft away. The natural gas has a recording flow meter at the control panel and an indicating flow meter at the crusher operator station.

With the above instruments and controls the dryer is started at the control panel, and the crusher operator from his station then takes over control of feed rate and dryer speed and can successfully operate the dryer from his remote location without additional manpower requirements.

Water From Deep Well

As for most of the plants in the Grants area, the water is supplied from a deep well. The well pump is automatically controlled by a level controller in the elevated water tower. Even the spillage sump pumps are automatically controlled by electronic capacitance type probes. This type of control with Teflon-coated probe was selected to eliminate the problems of solids buildup which would render float type and many other more conventional controls inoperative.

Throughout the plant, close correlation of design and the judicious use of instrumentation and automatic controls have enabled operation of the plant with an operator force of nine men and one supervisor per shift.

MONTREAL played host to the sessions. K. Ed (left), is Montreal Branch chairman, and C. Gerow is national secretary.

INCOMING president is Dr. J. C. Sproule (right), geological consultant, succeeding D. G. Burchell of Bras d'Or Coal.

INCO PLATINUM medal went to M. S. Fotheringham (left) for his work in developing a difficult iron ore deposit, resulting in a valuable contribution to Canada's economy.

AT THE HEAD TABLE—left to right—J. A. Maloney, Ontario Minister of Mines; N. Fisher; J. C. Sproule; Alvin Hamilton, Canada's Minister of Northern Affairs; and D. G. Burchell.

CIMM Convention Stresses Instrumentation

MICHAEL GUTWILLIG

INSTRUMENTATION in the field, the mine and mill, a detailed analysis of a great Canadian enterprise—Gaspe Copper Ltd.—and Canadian ownership of Canada's natural resources got star billing at the 61st annual meeting of the Canadian Institute of Mining & Metallurgy at Montreal, Quebec, April 13 to 15. Registration—an Institute record—was over 2,000 for the 90 technical sessions.

Among the coverage highlights on Noranda Copper's new mining enterprise at Murdochville in Quebec's Gaspe Peninsula were these:

Trackless mining: John Hall, mine superintendent, reported equipment used consists of high tower and lower type drill jumbos, 2½- and 1½-cubic yd shovels, 11.5- and 6-cubic yd off highway haulage trucks, high reach mobile aerial platforms, bulldozers and front-end loaders. Trackless development work from production areas is achieved by electric motor gathering-arm loaders, diesel and air motor overhead loaders, shuttle cars and small trucks.

Concentrator operations: R. L. Coleman, concentrator superintendent, and W. H. Muloin, assistant concentrator superintendent, described a brown and chute installation in the underground crushing and conveying system. Performance of the original jaw crusher safety toggles and cone crusher liners was unsatisfactory. Alternate designs are now in service. In the concentrator, two big problems were corrosion and abrasion. Certain designs were revised and more linings added. Unusual features in the tailing disposal set-up were also discussed.

Smelter operations: R. L. Johnston smelter superintendent, said treatment of custom concentrates has helped to step up smelter tonnage. He reported on recent changes in smelter

Mr. Gutwillig is McGraw-Hill World News correspondent, Montreal, Quebec.

operation, including a new shuttle belt conveyor feeding system for the reverberatory furnace.

Mine engineering: Under surveying methods, chief mine engineer J. B. Watts pointed out that, for room and pillar stope surveys, a departure was Gaspe's method of carrying survey control through production areas. Survey stations on the back or on the floor are not practical because the working faces are 30 to 40 ft high. To solve the problem, Gaspe established survey plugs in pairs—one on each side of the stope, about 3 ft above the floor at regular intervals. A notched 4-in. lag screw is used in place of the usual stainless steel spad. During the survey, a line is stretched from station to station. The instrument is set up over the line and backsights taken to the station. Then, surveying proceeds in normal fashion.

Town of Murdochville: R. J. McKenna, town manager, provided a portrait of a modern mining centre—its services and activities.

A forum on instrumentation attracted interest in the Metallurgy Division of the meetings: H. L. Ames, concentrator superintendent at Noranda Mines Ltd., described the pH measurement and control equipment installed at Noranda. He covered 1) relationship between pH and regular titrations; 2) production of a continuous relatively clear test solution for the electrodes; 3) the effect and correction for the long circuit time lags; 4) the wide and frequent variations in soda ash requirements and 5) a brief description of the soda ash slurry storage system.

In a paper called "Tonnage and Density Control in the Quemont Grinding Circuit," Quemont Mining Corp. personnel outlined instrumentation needed to control ore feeding conveyors and thus maintain a constant pre-set feed tonnage to a rod mill.

D. B. Smith, mill superintendent, Consolidated Denison Mines Ltd., Spragge, Ont., said the mineral benefication metallurgist approaches mill instrumentation from these angles: 1) Will it provide improved metallurgical control and save either mineral or operating supplies in amounts of economic significance? 2) Increase labor productivity? 3) Reduce safety hazards? 4) Operate in a reliable and dependable manner under rigorous conditions without excessive maintenance charges? 5) Be so reasonable in first cost that even the smaller mill can avail itself of its services?

"What the Extraction Metallurgist Wants From Instrumentation" was the topic of a contribution by D. A. Fraser, assistant mill superintendent for International Nickel at Copper Cliff. He outlined variables needing control in unit operations of roasting, smelting, leaching and refining.

Also in the Metallurgy Division, J. Girard, mill superintendent for Molybdenite Corp. of Canada Ltd. at Val d'Or, Quebec, told of a separation problem between molybdenite and valuable bismuth mineral. Molybdenite of Canada adopted a chemical treatment of the bulk concentrate obtained by flotation. Their acid leaching method enables the concentrator to recover bismuth in metallic form. It also yields a molybdenite concentrate practically free from other metallic minerals—suited to a well diversified molybdenite market.

In the Metal Mining Division, H. E. Farnam, Jr., manager of operations, Iron Ore Co. of Canada, reported on experience with slurried explosives over a period of 12 months. He found slurry has these advantages: high detonation pressure, high specific gravity and complete water compatibility.

Slurry costs more than ammonium nitrate and fuel do-it-yourself mixture. But, because it has excellent explosive performance, Farnam said the operator can use wider drilling patterns. Lower drill costs, better rock fragmentation and greater all-around flexibility were among the benefits cited.

The complexities of sub-arctic mining were handled by W. W. Weber of North Rankin Nickel Mines Ltd., and S. S. Teal of Consolidated Mogul Mines Ltd., Toronto. They placed special emphasis on such northern problems as labor, water supply, services, supplies, concentrate handling and transportation on "Canada's last frontier."

In the Geology Division of the meeting, a wrap-up on occurrence of massive sulphides in Canada saw participation of nine Canadian provinces and the Northwest Territories.

George M. Brownell, chairman of the department of geology, University of Manitoba, made a case for greater focus on finding non-pegmatitic deposits of beryllium to relieve the beryllium shortage. He reported on the "berylometer", a new geophysical tool designed to speed exploration of beryllium deposits.

J. B. Prendergast, Sulmac Exploration Services, Ltd., Toronto, laid out a typical large-scale exploration program—from its inception to exploration drilling. He covered methods used, logistics, costs, data evaluation and drill testing.

How to cope with the high cost of today's exploration methods—including airborne surveys—was the topic of a paper by Karl J. Springer, president, Leitch Gold Mines Ltd. Toronto. He showed how six mining companies got together to form the Mattagami Syndicate to survey a 600-sq mile area of northwestern Quebec and located the Mattagami orebody.

R. A. Bosschart, consulting geophysicist, Toronto, held that "the ground survey is gradually becoming a second phase operation." The advent of airborne geophysics has modified the role of ground methods. He gave field examples to show how quantitative data picked up from the results of two electromagnetic compensation methods can be used to eliminate undesirable anomalies and avoid unnecessary drilling.

Asbestos drew most of the attention in the Industrial Minerals Division, with reports from Canadian Johns Manville, Lake Asbestos of Quebec, and Asbestos Corp. Ltd. But there were papers on potash, limestone and sulphur too.

At the annual dinner, Canada's Minister of Northern Affairs and National Resources, Alvin Hamilton, traced the development of the Canadian iron ore industry—from 100,000 tons in 1939 to nearly 20-million tons a year 20 years later. Both Resources Minister Hamilton and Mines Minister Paul Comtois urged more mineral processing in Canada and greater Canadian financial participation in their mining industry.

Said Hamilton: "Where there are non-Canadian owners of Canada's raw materials, these owners frequently are not much interested in further processing of their goods in Canada. For such companies, Canada digs the great big holes but has little—and sometimes no share—in the manufacturing. The impact is apparent when we stop to consider that 62% of our mining industry and 60% of our petroleum industry are owned outside the country."

New president of the Institute is John Campbell Sproule, a geological and exploration consultant in Calgary, Alberta. He takes over from D. G. Burchell, vice-president and general manager of the Bras d'Or Coal Co.

Floating Chile's Oxidized Gold Ores

PART TWO—Mr. Benitez continues his discussion of the problem of Chile's oxidized gold ores and presents the solutions achieved at Domeyko, Punta del Cobre and Punitaqui. Part One appeared in May 1959 E&MJ.

FERNANDO BENITEZ

Flotation Results at Domeyko Mill

FULL INVESTIGATIONS proved that the Domeyko district was capable of supplying a small mill with ore and that the ores from most of these mines were cleaner than those from the other camps. Since the Bank at the time was short of funds it was decided to make use of a semiportable mill which had been previously imported from Allis-Chalmers Mfg. Co. for a copper camp. This mill was started by the author in April 1932.

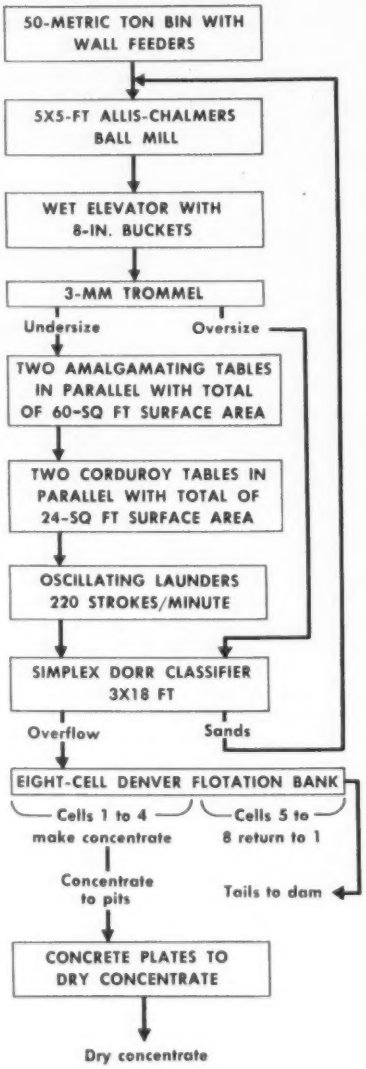
From the very start results showed that the mill suffered from several handicaps. The Blake crusher could only reduce the ore to 1½ in. and this cut the tonnage to 30 instead of 50 tpd. Amalgamating plates had a surface to a 2 sq ft per ton-day. The plates had a 15% slope and dilution was 4:1 with all the ore passing over them finer than 3 mm. The tables with sheepskins had only 24 sq ft of surface which was inadequate. The shaking launder was a dismal failure. The pH of the mill water was 7.6.

The overflow of the Dorr classifier went to an eight-cell No. 18 Denver flotation machine. The pulp was fed to the first cell and a final concentrate was taken off from the first four cells. Froth from the last four cells was returned to the first and second cells.

The careful test work carried out in this mill proved that the best reagent combination was:

Reagent	Point of addition	Quantity (lb/ton)
Pine oil		
G.N.S. No. 5	Ball mill	0.08
Aerofloat 25	Classifier overflow	0.1 to 0.3
K-ethyl xanthate	Classifier overflow	0.2
Na-silicate	First cell	Depending on the amount of clay the ore carried

Oxidized Gold Flowsheet
Domeyko Mill, Chile


50-METRIC TON BIN WITH WALL FEEDERS
5X5-FT ALLIS-CHALMERS BALL MILL
WET ELEVATOR WITH 8-IN. BUCKETS
3-MM TROMMEL
Undersize
Oversize
TWO AMALGAMATING TABLES IN PARALLEL WITH TOTAL OF 60-SQ FT SURFACE AREA
TWO CORDUROY TABLES IN PARALLEL WITH TOTAL OF 24-SQ FT SURFACE AREA
OSCILLATING LAUNDERS 220 STROKES/MINUTE
SIMPLEX DORR CLASSIFIER 3X18 FT
Overflow
Sands
EIGHT-CELL DENVER FLOTATION BANK
Cells 1 to 4 make concentrate
Cells 5 to 8 return to 1
Concentrate to pits
Tails to dam
CONCRETE PLATES TO DRY CONCENTRATE
Dry concentrate

As had been said, the Domeyko ores had a large proportion of clean quartz and carried less limonite, clay and kaolin than the ores from the other camps where gold ores were being floated, and consequently needed larger amounts of frothers to make a stable froth. Na-silicate was first tried to rid the cleaner froth from clays and limonite. However, the reagent had to be used with care, since even a small excess made the froth very thin and the effect known as "weeping" was produced.

The gold, which was practically all free, was very finely divided through the gangue as was proved by the fact that the plus 48 mesh in the tails carried 0.4 oz per ton. Therefore, grinding was adjusted to 1% on 65 mesh Tyler. After the classifier was adjusted to obtain this grinding the screen analysis of the tails was:

Plus 48 mesh Tyler	0.20%
Plus 65 mesh Tyler	0.70%
Plus 100 mesh Tyler	3.40%
Plus 150 mesh Tyler	8.00%
Plus 200 mesh Tyler	9.70%
Minus 200 mesh Tyler	78.00%
	100.00%

The screen analysis of the concentrate was:

Plus 48 mesh Tyler	0.30%
Plus 65 mesh Tyler	0.10%
Plus 100 mesh Tyler	1.20%
Plus 150 mesh Tyler	1.30%
Plus 200 mesh Tyler	0.80%
Minus 200 mesh Tyler	95.50%
TOTAL	99.20%

During the break-in period to which all the above figures refer, the results obtained were as follows after grinding was adjusted to 1% on 65 mesh.

	Ounce/ton
Average grade of ore during test period	0.61
Average grade of ore flotation concentrate	5.00
Average grade of ore flotation tails	0.135
Average percent recovery	80.0%
Ratio of concentration	25:1

This ratio of concentration refers to the flotation feed which was only 0.33 oz Au per ton, the rest of the gold being recovered by the corduroy or sheep skins tables.

Further testing proved that many of the gold ores of the Domeyko district were amenable to cyanidation with a better recovery, and as the financial situation of the Bank had changed, a cyanide mill with capacity to handle all the clean ores of the district was built at Domeyko (while the non-cyanidable ores were shipped to the Punta del Cobre flotation mill).

As the results that were being ob-

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tained in the flotation of the ores were not satisfactory it was decided to intensify test work at the Bank's main testing laboratory in Santiago as well as in the mills themselves, making a special investigation of all collectors on the market.

Simultaneously, it was decided to send samples of the gold ores to several of the best known metallurgical laboratories in the U.S. However, the results obtained by these were not better in any way to those being got by the mills themselves at that time.

Success at Punta del Cobre

The detailed test work in the field was carried out by the author at the metallurgical laboratory of the Punta del Cobre flotation mill which had at the time the largest stock of gold ores to treat, 22,000 tons, and to which many thousands of tons of oxidized gold ores were arriving every month.

All the flotation test work was carried out in a two-kilo Denver flotation machine and every test was done twice under exactly identical conditions. C. Neuenschwander was superintendent at the Punta del Cobre mill and his assistant at that time was H. Garcia.

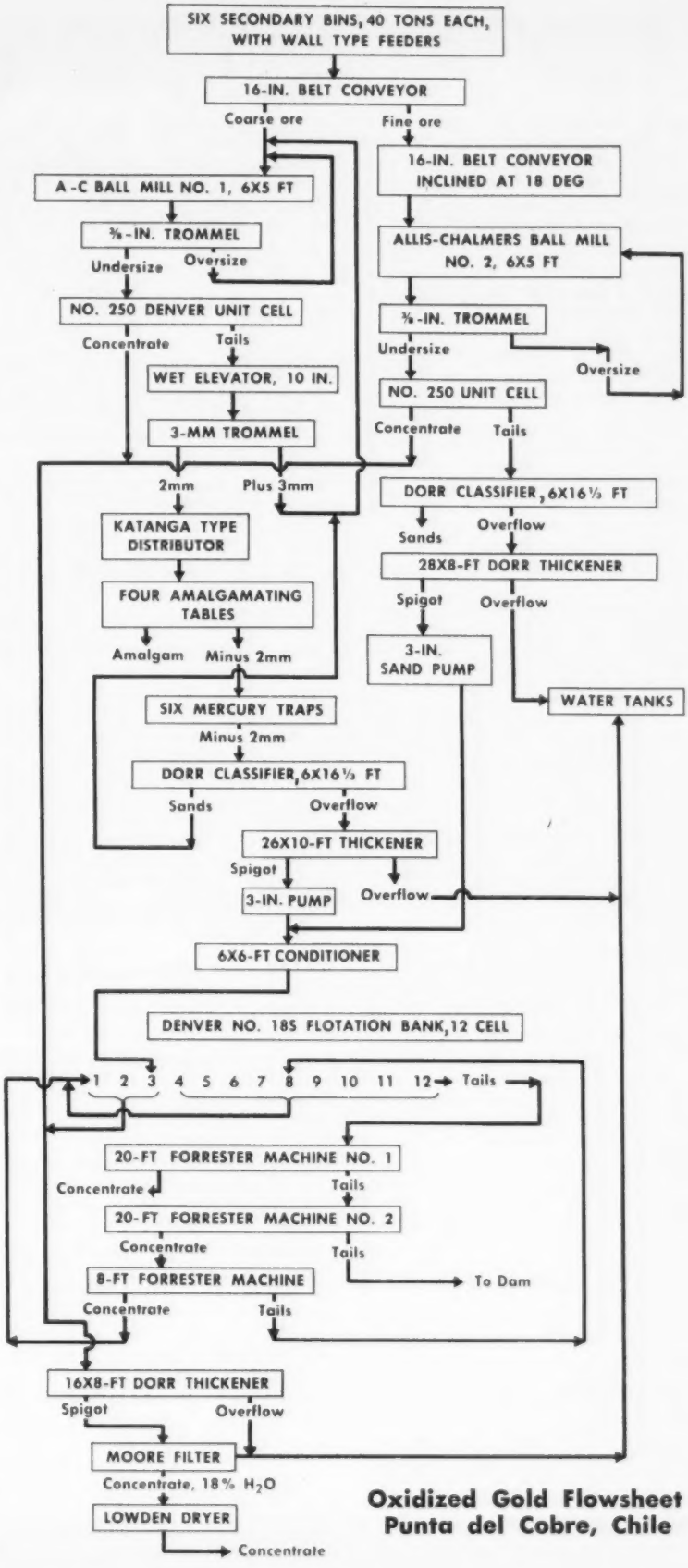
Though many years have elapsed since that time, the author will always recollect with pleasure as one of the most pleasant and fruitful of his technical associations the difficult work carried out at the Punta del Cobre mill under trying circumstances and the loyal assistance and the fruitful results obtained from the enlightened discussion with these two engineers who made the gruelling work at Punta del Cobre a real pleasure.

The investigation carried out at Punta del Cobre included:

a) the optimum commercial grinding
b) the optimum flotation time
c) the best reagent combination
d) the optimum pH
e) the effect of modifying agents
f) dilution

The experimental work was carried out on a 22,000-ton blended lot of gold ores of varied mineralogical composition which had accumulated because of insufficient capacity of the mill to handle all the tonnage of gold ore bought.

This was an unwise procedure, but imposed for economic reasons. Later the ores were separated in lots according to districts and their gangue



Oxidized Gold Flowsheet Punta del Cobre, Chile

content or characteristics such as:

a) clean quartz
b) hematite
c) clayey
d) talcose

Detailed test work was also carried out separately on each of these types.

The following concordant results were obtained beyond any possible doubt on the several ore types:

a) Grinding had to be carried out to at least 80% minus 200 mesh but even at this mesh not all of the gold was liberated.

b) With the 22,000-ton lot of ore, the grade of concentrate obtained after 48 min flotation time was greater than that of the heads.

c) The best reagent combination proved to be:

G.N.S. No. 5 pine oil as frother, Aerofloat 25 and Santiago Gas Works creosote as frother-collector and 301 as collector of the free gold.

d) Optimum pH was that of the water of the nearby Copiapo River.

e) Though the following modifying agents were tried, none proved helpful: CaO, Na_2CO_3, Na_2S, $CuSO_4$ (did not increase speed of flotation or gold recovery) and Na_2SiO_3.

f) A 4:1 ratio of water to solids proved to be the best, but for practical reasons it was not possible to keep within this figure in the mill.

Bringing Down the Tails

On account of the satisfactory results obtained in the test work, it was decided to carry out some improvements immediately such as to grind to 80% minus 200 mesh and to increase flotation time by inserting in the circuit a 20-in. Forrester machine with double overflow.

The Forrester at once brought down the tails by 0.058 oz per ton. However, to reach 80% minus 200 mesh in a 4 ft 6 in. classifier proved quite a job since it was necessary to increase dilution to 10:1—a dilution that reduced flotation time to less than half in spite of the 20-in. Forrester. Based on the results obtained, the following improvements were slowly introduced in the mill:

a) A Plat-O vibrating screen was introduced after the elevator's discharge to insure a minus ½-in. feed to the ball mills. Oversize from the screen went back to the MacCully gyratory.

b) Another 6x5-ft Allis-Chalmers ball mill was installed to grind to 80% minus 200 mesh Tyler. Though in open circuit at first it was later placed in closed circuit with the 4 ft 6 in. x 16 ft 4 in. Dorr classifier.

c) Denver No. 250 unit cells were introduced between ball mills and classifier, and to prevent coarse discharge from the ball mills getting into the unit cells, trommels were bottled to the discharge bells of the ball mills.

d) Amalgamation was introduced in the circuit of No. 1 ball mill. Though amalgamation did not increase the over-all recovery, a greater value was obtained for the gold sold in the metallic form than for gold sold as concentrate.

Amalgamation Circuit

e) The amalgamation circuit was made up of:

1) A 35-ft elevator with 10-in. buckets which elevated the undersize from the mill's trommel and delivered it to a 6-ft trommel in the shape of a hexagonal prism with a cloth having 3-mm openings inclined at 6 deg and running at 13 rpm. Oversize from the trommel goes back to the mill.

2) A Katanga feed splitter which divided the pulp (minus 2 mm) into four equal parts.

3) Four amalgamating tables, each made up of 3⅛-in. copper plates per table inclined at 15% with a 2-in. drop from plate to plate. Therefore, there were 192 sq ft of plates and four mercury traps. Tails flowed back to the classifier of ball mill No. 1.

f) Another 20-in. Forrester machine was placed in series with the first one.

g) The concentrate from both 20-ft Forresters was cleaned in an 8-ft Forrester discharging on one side only. The concentrate from the 8-ft Forrester was fed to No. 3 cell of the Denver machine and the tail to cell No. 7 because they belonged there according to their assays.

h) Two 20x10-ft Dorr thickeners were installed to receive the overflow from the Dorr classifiers with a 10:1 dilution and reduce it to 6:1. The thickened pulp was pumped by 3-in. Krogh pumps at 1800 rpm and fed to a 6x6-ft Denver conditioner from where it went to the flotation circuit.

i) The slope of the two classifiers was reduced from 2¾ in. to 2½ in. per foot and the speed was reduced to 16 strokes per minute. The rakes were also modified within the pool to decrease agitation to a minimum. Also the width of the classifiers was increased to 6 ft to increase the pool area in order to obtain a finer overflow with less dilution.

j) A Moore type filter was installed with an 18-in. vacuum pump, 20-lb compressor and 10-hp motor.

k) Later a Lawden dryer was installed to facilitate drying the concentrate in wintertime.

These changes and improvements permitted:

1) An increase in capacity of the mill to 120 tpd with a consumption of energy of 172 kw in the two ball mill-classifiers circuits, which amounts to 34.4 kwh/ton grinding to what at times amounted to 90% minus 200 mesh.

2) To recover by amalgamation 30% of the total gold which was recovered in circuit No. 1.

3) To recover part of the coarser free gold (there was really no actual coarse gold in the ores) in the concentrate and cones of the unit cells. Later these were replaced by Denver jigs.

4) To increase flotation time from 34 minutes when 55 tpd were milled with 12 Denver No. 18 Special cells to 37 minutes treating 120 tpd.

5) Increase gold recovery to 70 to 80% depending on the ores treated. The increase in flotation time had the added advantage that recovery did not depend so much as before on almost minute-to-minute attention to the flotation machines and especially to the levels of the pulp in the Denver machine.

Other characteristics of the mill:

Ball Charge

No. 1 ball mill (coarse feed)

	Metric tons
5-in. balls	2.475
4-in. balls	1.650
3-in. balls	1.375
	5.500

No. 2 ball mill (fine feed)

	Metric tons
3-in. balls	3.10
2-in. balls	2.25
1½-in. balls	2.25
	7.60

Energy intake 90kw

Liner life:	**Tons**
Cylinder	36,500
Heads	28,600
Pinion	18,000

Ball consumption ..... 4.2 lb/ton
Dilution in ball mills 76% solids

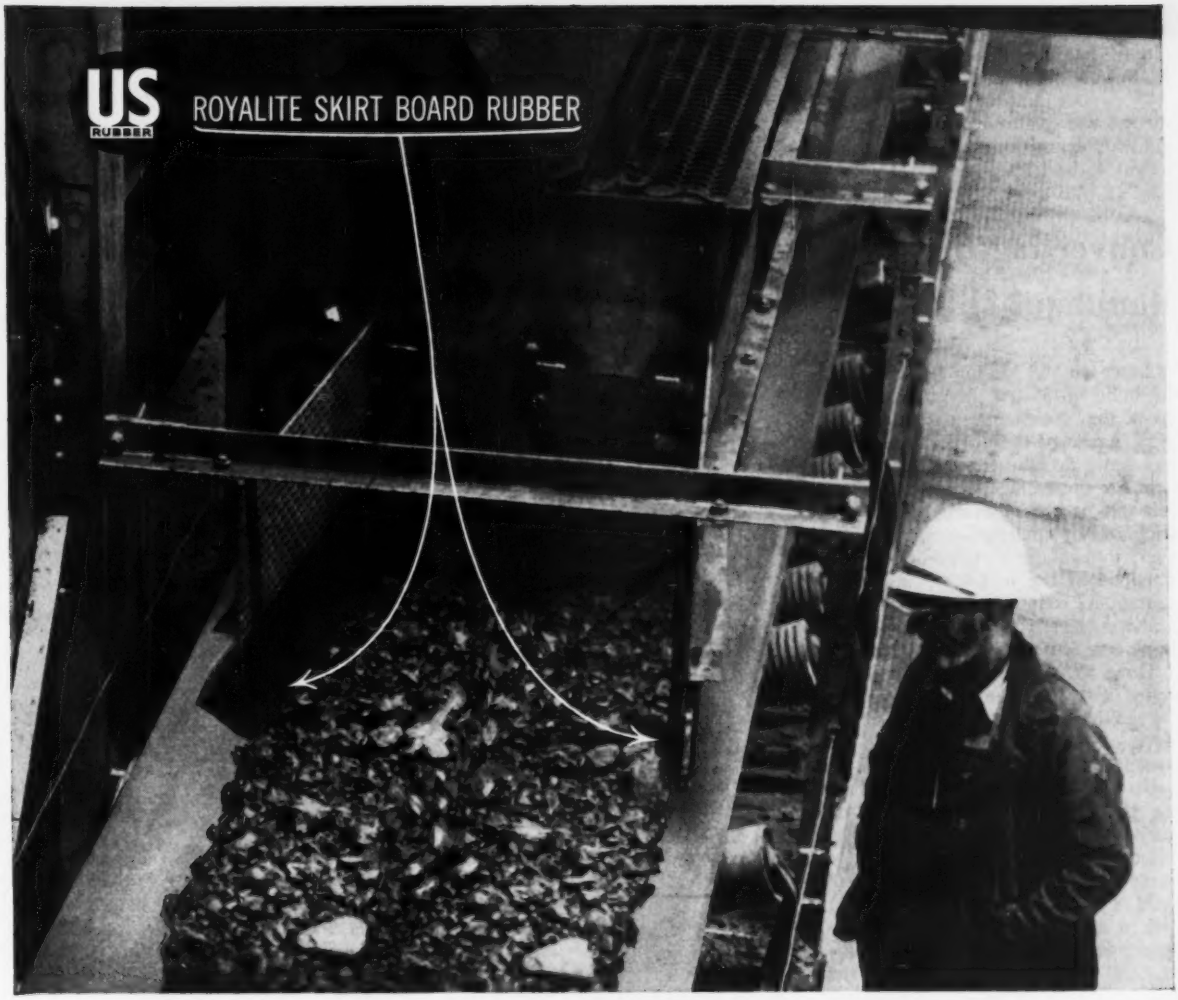
Flotation cells

No. 250 Denver Unit cells, 18-in. impellers at 385 rpm

No. 18 Special Denver cells, 18-in. impellers at 390 rpm

Forrester cells, 980 cubic ft of air per minute at 2 lb with main air header of 11-in. dia and ¾-in. pipe feeders spaced at 4 in.

The greatly improved results that were obtained in this mill with the changes and improvements described served as a basis for the design of all the gold flotation mills built later in Chile. The Bank itself soon afterwards applied the very same changes to the El Salado mill but very soon



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had to take out the amalgamation circuit because of the fact that at El Salado the milling water contains 145 g/l of NaCl. This salty water dirtied the plates very rapidly and gold amalgamation was so poor that it was a dead loss.

Converting the Punitaqui Mill

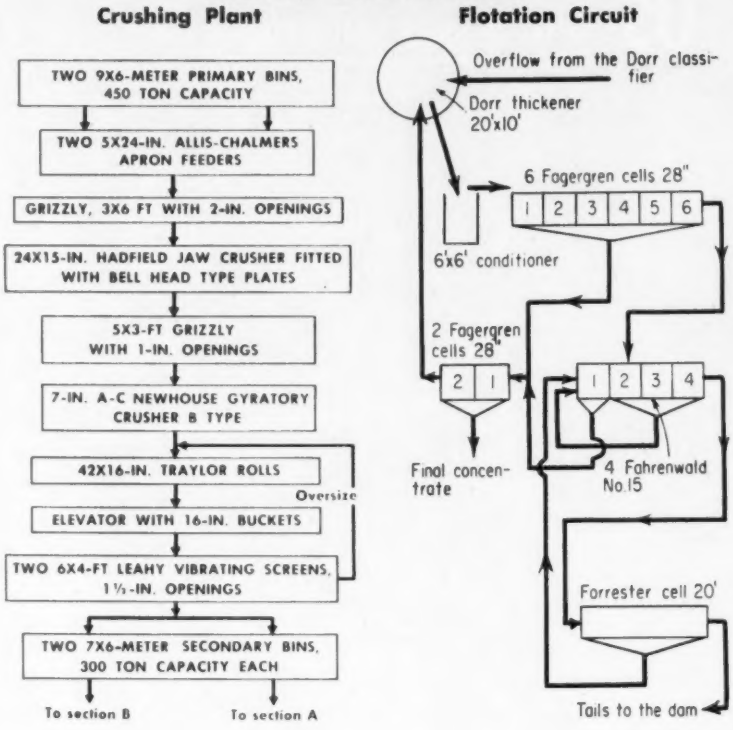
Later on the Milling Bank decided to build a 30-tpd flotation mill to treat the completely oxidized gold-copper ores of the district. Practically the same flowsheet was adopted except for the amalgamation which was left out because the ores of the district do not amalgamate at all. However, though the metallurgical results obtained at the mill were up to expectations, economically such a small mill was always run at a loss and the Bank was forced to shut it down.

However, the Bank's policy compelled it to continue buying the milling gold ores of the camp. Soon a stock of 44,000 tons of ore had accumulated, worth $350,000. Since the Bank was compelled to continue buying the ores, two alternatives presented themselves in order to treat this ore plus some 30 tons that were being bought daily. The first was to build a new, better and larger mill with a capacity of 100 tpd, which experience had proved to be the smallest possible capacity when the ores have to be bought and the miner paid the best possible schedule; and the second to accept the offer of Cia. Minera Punitaqui which had a very good 400-tpd mill located only a few miles from where the Bank had accumulated its stock. The accumulated stock and the fresh ore bought was to be milled at a fixed charge per ton but under the writer's direct metallurgical supervision.

Though at the time very considerable theoretical and practical experience had already been gained as to the best way to treat these oxidized gold ores by flotation—cyanidation was out of the question because of oxidized copper content—it was decided by the Bank's board that the author should carry out exhaustive tests at the testing laboratory of said company at Punitaqui before milling these ores on a plant scale. When the test work was finished it was proved once more that it was essential to comply with the following conditions before a satisfactory recovery was obtained:

1. Grinding must be carried out at least 80% minus 200 mesh Tyler.

Compania Minera Punitaqui, S.A., Chile
Oxidized Gold Flowsheet


Crushing Plant
Flotation Circuit
TWO 9X6-METER PRIMARY BINS, 450 TON CAPACITY
TWO 5X24-IN. ALLIS-CHALMERS APRON FEEDERS
GRIZZLY, 3X6 FT WITH 2-IN. OPENINGS
24X15-IN. HADFIELD JAW CRUSHER FITTED WITH BELL HEAD TYPE PLATES
5X3-FT GRIZZLY WITH 1-IN. OPENINGS
7-IN. A-C NEWHOUSE GYRATORY CRUSHER B TYPE
42X16-IN. TRAYLOR ROLLS
Oversize
ELEVATOR WITH 16-IN. BUCKETS
TWO 6X4-FT LEAHY VIBRATING SCREENS, 1½-IN. OPENINGS
TWO 7X6-METER SECONDARY BINS, 300 TON CAPACITY EACH
To section B
To section A
Overflow from the Dorr classifier
Dorr thickener 20'x10'
6 Fagergren cells 28"
1 2 3 4 5 6
6'x6' conditioner
2 Fagergren cells 28"
2 1
1 2 3 4
Final concentrate
4 Fahrenwald No.15
Forrester cell 20'
Tails to the dam

2. Flotation time must be at least 30 minutes.

3. The combination of reagents should be: G.N.S. No. 5 pine oil, 0.1 lb per ton; 0.2 lb per ton of Aero Xanthate 301; pH of 8.6 to 8.8 should be reached with CaO. Also a few grams of Aero Promoter 712 were a help.

The author never found that in the flotation of oxidized Chilean gold ores, the addition of lime was detrimental as many authors assert. Five to 10 gm per ton of Aero Promoter 712 added ahead of the Forrester machines helped very considerably to improve the type of froth obtained by maintaining a good blanket of froth on the air machines.

The very small amount of Aero Promoter 712 carried over by the froth from the Forresters into the mechanical machines also helped in maintaining a good blanket of froth in the Fagergren machines without bothering to tamper with the levels during whole shifts and its effect at this place of the circuit was far superior to pine oil.

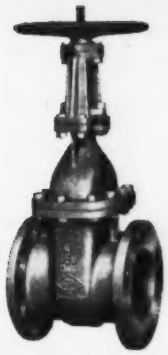
Practically all collectors manufactured at that time were tried but none gave better results than Aero Xanthate 301.

Testing some of the 44,000 tons of stock ore in the mill of the Punitaqui Co. and which was made up of two sections B and A, having a capacity of 242 and 198 tpd respectively prove, that though the flowsheet was satisfactory in the treatment of the sulphide ores of the Punitaqui Co., it was not good enough to treat the 44,000 tons of the Bank's stock that came from many different mines and which contained even tailings from amalgamating the ores in Chilean Mills.

The main difficulties encountered in the beneficiation of these ores in the Punitaqui mill were as follows:

The chemical classifiers of the old Dorr type built by Humboldt in Germany did not permit a grind of 80% minus 200 mesh as the stock ore demanded in order to reach the 70% plus recovery that the contract called for.

To reach a minus 200 mesh 80% grind, a Hardinge type bowl was placed in series with the standard rake classifier and the overflow from the Humboldt classifier was pumped by a 3-in. Wilfley to the Hardinge bowl, the sands from this were fed by gravity to the ball mill while its overflow was fed to the flotation section. Though the grinding of this section with the two classifiers in series allowed us to get finer grinding than in the other section working with only one classifier, mechanical difficulties prevented us from obtaining



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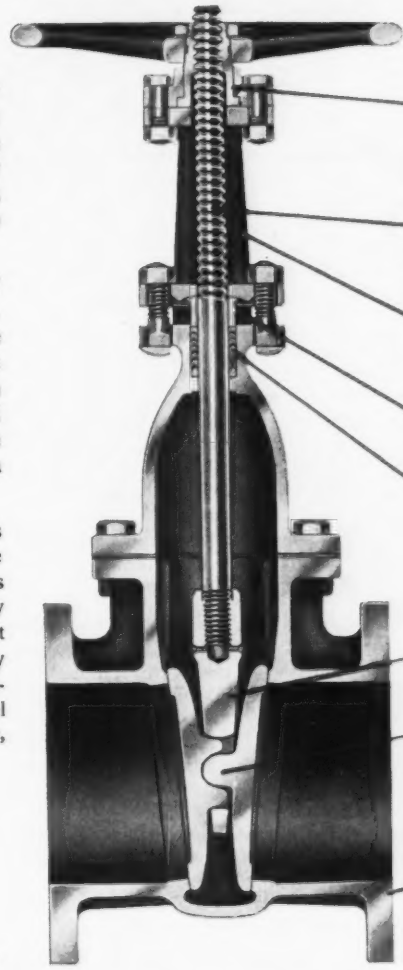

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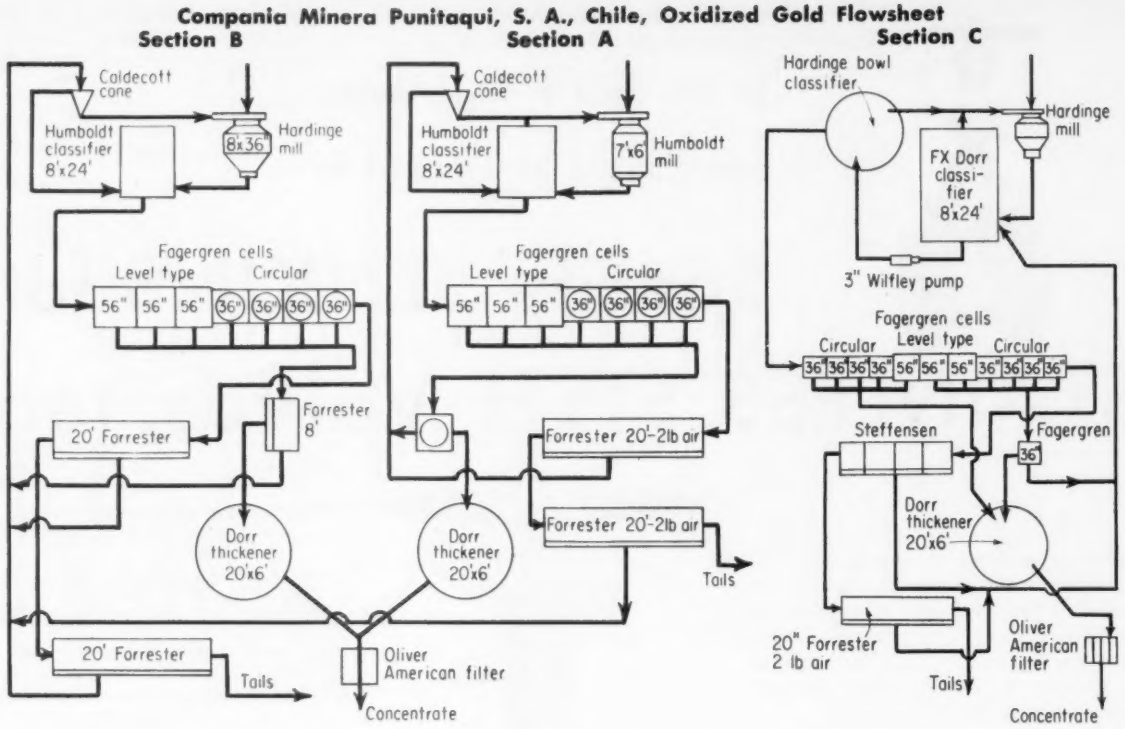
Compania Minera Punitaqui, S. A., Chile, Oxidized Gold Flowsheet



the full advantage of the double classification. Though the hardness of the oxidized ores contained in the 44,000 ton stock was not greater than that of the sulphide ore coming from the Punitaqui Co. mine, the tonnage of oxidized ore ground was reduced from 440 to 326 tpd, a reduction of 26%.

The flotation time was as follows:

Three 56-in. Fagergren cells
at 47 cubic ft each = 141 cubic ft
Four 36-in. Fagergren cells
at 13 cubic ft each = 52 cubic ft
Two 20-ft Forresters cells
at 146 cubic ft each = 292 cubic ft
485 cubic ft

$$\frac{485}{35.3} = 13.7 \text{ cubic m}$$

The ores had a sp gr of 2.6 and as the total volume of pulp was 4.15 m^3 per ton and the two sections A and B ground 133 and 167 metric tpd each, the flotation time was 36 and 29 minutes. The reagents used during the trial runs in the two sections of the mill were based on laboratory work and later adjusted to plant needs.

	lb per metric ton
G.N.S. No. 5 pine oil	0.136
Aero Promoter 301	0.237
Aero Promoter 712	0.014 (minimum)
	0.024 (maximum)
Lime as CaO	7.300

The quantity of Aero Promoter 712 added depended on the amount of froth made by the ore—which varied from day to day—with a fixed quantity of pine oil. The amount of water returned from the tailings dam also had an influence on the quantity of Aero Promoter 712 which had to be added to have a good blanket of froth in the Forresters.

The lime fed was regulated to obtain a pH of 8.6 to 8.8 and 7.3 lb per ton represents the average.

Points of reagent addition. Lime was added to the ball mills, all the pine oil and part of the Aero Promoter 712 and also Aero Xanthate 301 to the classifier overflow; another portion of 301 to the 1st 56-in. Fagergren and to the No. 4 Fagergren and the rest of 712 and 301 ahead of the No. 1 Forrester.

The mill test lasted eight days and from this work the following conclusions could be drawn:

That as shown by the lab test work, it was necessary to reach a grinding of at least 80% minus 200 mesh to obtain a plus 70% recovery of gold contained in the 44,000 short tons stockpile.

That to reach such fineness it was necessary to place the Hardinge bowl classifier after the Humboldt rake.

Taking into consideration that the Punitaqui Co. was building a new section made up of an 8x3-ft Hardinge mill and an 8-ft FX Dorr classifier, it was decided between the Bank and the company to wait until this section was built to begin the beneficiation of the accumulated stockpile.

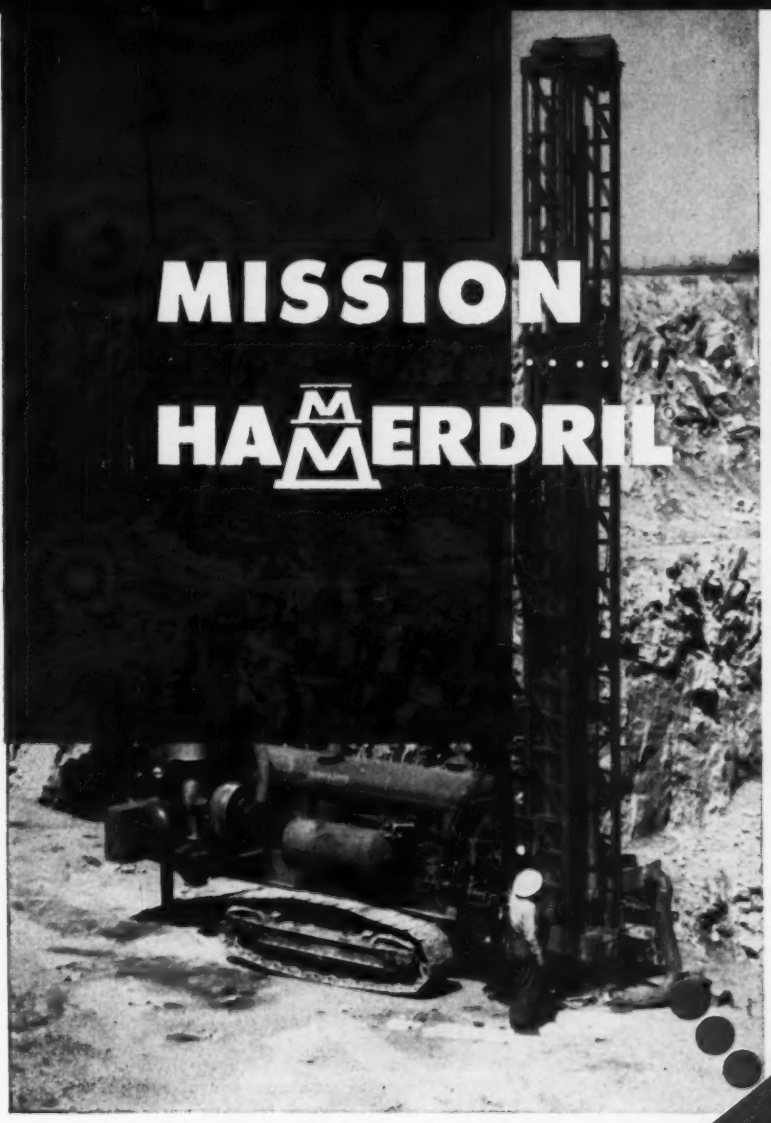
When the combination of FX Dorr Classifier and Hardinge bowl were installed, it was possible to eliminate all of the mechanical troubles that had bothered us during the test work in the mill itself. Thereafter the combination of the two classifiers in series and the 3-in. Wilfley worked in perfect synchronism and it was easy to obtain an 80% minus 200 mesh grind.

The flotation machines in this section were made up as follows:

Four 36-in. Fagergrens, 52 cubic ft
Three 56-in. Fagergrens, 141 cubic ft
Four 36-in. Fagergrens, 52 cubic ft
Four Steffensens, 224 cubic ft
One Forrester, 146 cubic ft

Total volume = 615 cubic ft

The beneficiation of almost 50,000 short tons of oxidized gold ores stockpile plus the ore bought during the time this stock was treated which, as had been said came from nearly 100 different mines, gave an effective recovering of 71.9%, the ore treated had an average grade of 0.40 oz per ton and the grade of the concentrate was 7.25 oz of gold, 1.6 oz of silver and 3.65% copper. The average grade of the tailings was 0.129 oz gold per ton.



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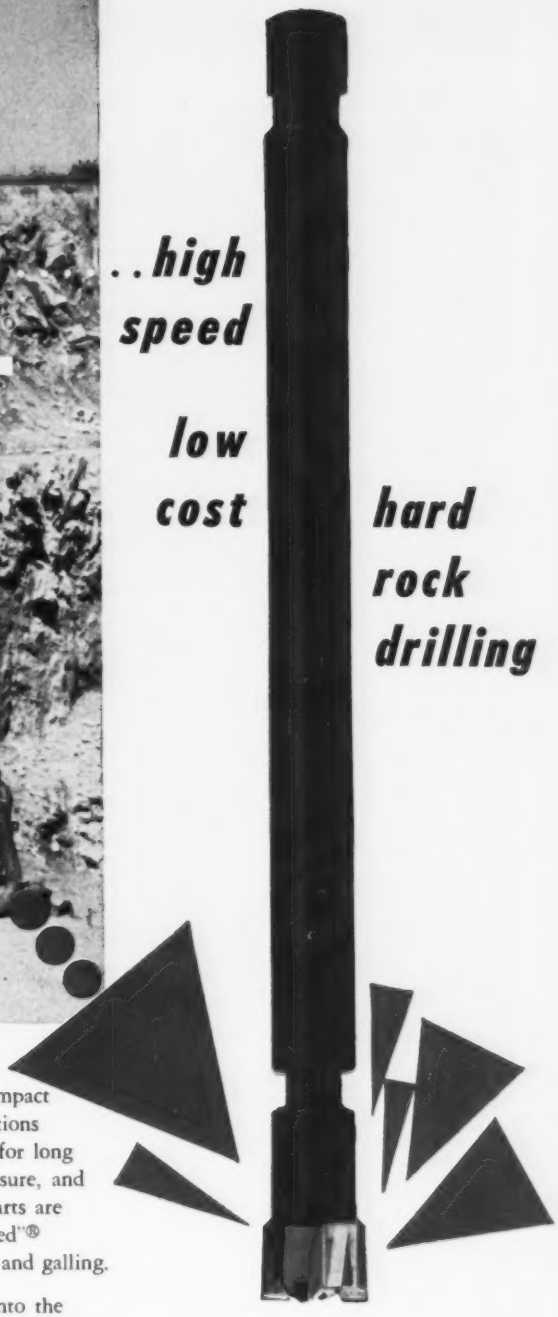

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Marks' Mechanical Engineers' Handbook, sixth edition, revised by Theodore Baumeister, prepared by a staff of experts for McGraw-Hill. Generally the same format as previous editions, but with a lot of new modern data added. Published by McGraw-Hill Book Company, Inc., 330 West 42nd Street, New York 36, N.Y. 2270 pp. Price $23.50.

Geologie de l'Uranium, par Marcel Roubault avec la collaboration de George Jurain. L'etude est impressive et comprend essentiellement trois parties: Mineraux, prospection, generalites (116 pages); Description des principaux gisements uraniferes du monde (276 pages); et Conclusions—les reserves d'uranium et de thorium. Apercu general. Aspect economique. Probleme des reserves—Annexe; le thorium. Mineralogie. Prospection. Mason et Cie, Editeurs, 120, boulevard Saint-Germain, Paris-6e. Un volume de 462 pages avec 205 figures et cartes. 2 planches hors texte en couleurs. 9 tableaux. Pris—broche, 5,200 franc; cartonne toile, 6,000 franc.

Drilling & Blasting Symposium Proceedings consists of papers presented at the University of Minnesota, October 2-4, 1958, under sponsorship of the mining departments of Minnesota, Colorado School of Mines and Pennsylvania State University. The papers cover production drilling, drill steels, blasting, research, and general review of ideas and practice. Published by Center for Continuation Study, University of Minnesota, Minneapolis 14, Minnesota. 131pp. plus many illustrations.

Mathematical Methods of Operations Research, by Thomas L. Saaty, is a graduate level text that requires a fair knowledge of advanced calculus for background. It presents the principal methods and gathers much previously scattered theoretical and illustrative material. The author emphasizes throughout that the field is not one for merely using techniques but rather depends on applying a scientific and mathematical philosophy to solve operational problems. Published by McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 36, N.Y. 421pp. Price $10.

Rock Pressure in Mines, by E. de St. Q. Isaacson, is the first known text on the subject—although there have been many papers published. It is aimed at both advanced students and all who are in charge of underground workings. The author—well experienced in the Kolar Gold Fields—uses a practical approach rather than academic. But he does begin with the fundamentals of stress and strain in rock before discussing layout, design and support of workings. An excellent chapter is devoted to measurement of pressures and strain; another treats rock-bursts in some detail. The author also attempts to bring together some of the apparently divergent ideas on rock pressure and control. Published by Mining Publications, Ltd., 482, Salisbury House, London Wall, London, E.C. 2, England. 212pp. Price $6.30.

Principles of Underground Excavation (in German), by B. Stoces, is an outstandingly thorough and precise presentation which considers the selection of mining methods from very basic viewpoints—orientation and shape of orebody, structure of ground, et al. Illustrations are excellent and text is concise. Published by Ferdinand Enke Verlag, Hasenbergsteige 3, 14 (a) Stuttgart-W, Germany. 411pp. Price DM 47 ($11.75).

BOOKS presented on this page may be obtained by writing directly to the publisher mentioned in each individual item. E&MJ does not offer for sale any of this literature unless stated.

Underground Lighting, by A. Roberts, presents the fundamentals and terminology, the problems and solution techniques, and the latest equipment on a subject which is becoming of increasing concern to those in mine health and safety. It also covers lighting in civil works such as vehicular and subway tunnels. Published by The MacMillan Co., 60-5th Avenue, New York 11, New York. 292pp. Price $12.75.

Free Gold, the Story of Canadian Mining, by Arnold Hoffman, president Mesabi Iron Co. The two Hoffman brothers—Arnold and Bob—were pioneers in the Canadian north and created Quebec Cobalt & Exploration Ltd. A third brother, Irwin, did the illustrations. An insight into the doings and dealings in the Porcupine, Kirkland Lake, Noranda, Flin Flon and Rouyn camps. Published by Associated Book Service, Inc., 601 West 27th St., New York 1, N.Y. 392pp. Price $5.

Principles of Modern Physics, by Robert B. Leighton. An introductory text that concentrates on fundamentals, then moves into relativity, quantum mechanics and many of the recent noteworthy advances of physics—nonconservation of parity, strange particles, formation of the elements in the stars, nuclear shell structure, etc. Published by McGraw-Hill St., N.Y. 36, N.Y. 783pp. Price $12.50. Book Company, Inc., 330 West 42nd Street, New York 36, N.Y. Illustrated in 783pp. Price $12.50.

Basic Geology for Science and Engineering, by Edward C. Dapples. An introductory text for those interested in exploring the basic tenets of geology. Covers the usual subjects, plus a table for the determination of common minerals. Published by John Wiley & Sons, Inc., 440 4th Ave., New York 16, N.Y. Illustrated in 594pp. Price $9.50.

Economics For the Mineral Engineer, by Edmund James Pryor of the Royal School of Mines, Imperial College of Science and Technology, London. Discusses the general aspects of mineral economics—exploration, sampling, valuation, accounts and organization managerial structure, data gathering, mill records and management, new construction, the new plant, marketing, etc. Published by Pergamon Press, Inc., 122 East 55th St., New York 22, N.Y. 248pp. Price $6.

Metal Fatigue, edited by George Sines and J. L. Waisman. Leading authorities contributed their knowledge on the subject of metal fatigue for the edification of the machine design engineer. Published by McGraw-Hill Book Company, Inc., 330 West 42nd Street, New York 36, N.Y. Illustrated in 412pp. Price $12.50.

Plastic Design of Steel Frames, by Lynn S. Beedle. Said to be the first U.S. text that deals entirely with the topic, emphasizing the application of plastic methods to structural design. Published by John Wiley & Sons, Inc., 440 4th Ave., New York 16, N.Y. Illustrated in 396pp. Price $13.

Introduction to Chemical Engineering Thermodynamics, second edition, by J. M. Smith as part of the McGraw-Hill series in chemical engineering. A sound, easily understood treatment of thermodynamics and their major applications to the field of engineering. Revised from first edition. Published by McGraw-Hill Book Company, Inc., 330 West 42nd Street, New York 36, N.Y. 478pp. Price $8.75.

Advanced Mechanics of Fluids, edited by Hunter Rouse. Theoretical approach to fluid mechanics is emphasized along with field-gained experience. Published by John Wiley & Sons, Inc., 440 4th Ave., New York 16, N.Y. 436pp. Price $9.75.

Introduction to Geophysics, by Benjamin F. Howell, Jr. A solid text in geophysical theory and application for the undergraduate level. Text is restricted to the solid earth—in the origin, causes, distribution and nature of earthquakes and stressing the knowledge gained of the earth's interior. Published by McGraw-Hill Book Co. 388pp. Price $9.

TEXACO ORGANIZED LUBRICATION CAN HELP YOU...

Keep his guns from killing your profits

His grease guns are aimed at your profits; they can help boost them – or eliminate them altogether. Here's why:

You used to need a different grease for nearly every job. That meant 20 or 30 lubricants at the mine, with the almost inevitable danger of misapplication – and damaged machinery. *Now, with the rapidly increasing mechanization of mine operations, this can be a ruinously expensive policy.*

Yet, unless you are operating on the basis of a modern lubrication survey, *the chances are that this situation still exists at your mine!*

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LUBRICATION IS A MAJOR FACTOR IN COST CONTROL

(PARTS, INVENTORY, PRODUCTION, DOWNTIME, MAINTENANCE)

OPERATING IDEAS

Sand Helps to Dry Filter Cake

A SMALL CHANGE on the filter valves and a slower filter speed has reduced the moisture content of concentrates going from the mill to smelter at Kennecott Copper Corp.'s Nevada Mines Div., McGill, Nev.

The February 1959 issue of the division's magazine, KENNEVADAN, stated that "the excessive moisture in the concentrate is especially troublesome for a number of reasons. First, the more moisture there is in the concentrate when it is put in the reverberatory furnace at the smelter the more heat it takes to melt it. Therefore, if the moisture could be reduced, there would be a reduction in fuel costs. In addition, when the furnace is charged with concentrate, any water in it instantly converts to steam. If the water content is too high, the water will turn to steam with an explosive force."

Kennecott's crew modified the filter valves to enable a porous layer of sand to be picked up first (see photo). This acted as a protective layer to keep slimes from reaching the filter cloth and choking it. The company also found that moisture could be reduced even further by maintaining low tub pulp levers.

These changes were completed on half of the plant filters in early January of this year. Since then, concentrate moisture has been reduced 24%, "which has eliminated air drying and allowed direct shipment to the smelter."

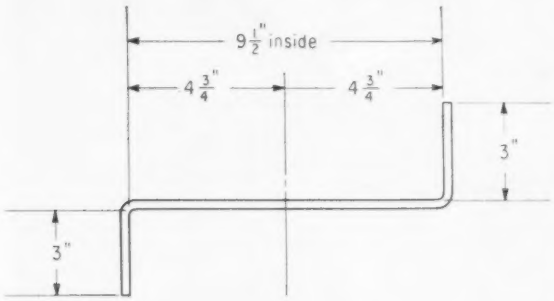


Plate Eases Gangway Timbering

A SPECIALLY DESIGNED steel bracket has brought about a sizeable saving in costs and handling charges at Zinc Corp. Ltd.'s Broken Hill mine, New South Wales, Australia.

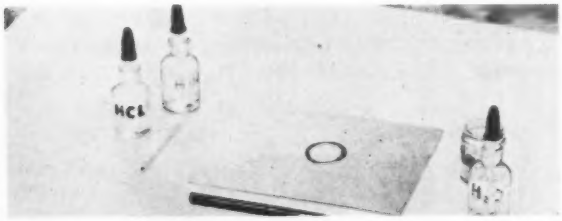
The new brackets are used in place of timber spreaders in gangway sets. The mine's practice with gangway timbering is to use clamp-me-down sets of 10x10-in. hardwood timber. The normal practice is to spread the legs by 10x3-in. hardwood spreader spiked to the underside of the cap.

This has now been replaced by the steel bracket nailed to the top of each leg. The cost of the two brackets is only about 60% of the cost of the timber spreader and handling charges are also lower.

New Electric Arc-Compressed Air Torch Speeds Dismantling Job

REMOVAL OF A five-story crusher and building at Fultonham, Ohio, developed into a major project for the George P. Dysart Inc. steel erection firm. The structure, property of Columbia-Southern Chemical Corp., was erected 40 years ago, and, the contractor learned, had been built to stay.

The structure's manganese plates had been grouted in place with zinc, and it found that application of a torch to the 28x24x6-in. plates merely melted the metal while leaving it nearly intact. Lincoln Electric Co., which had supplied the arc welding machine used in the first attempt, recommended the use of a torch which uses the melting power of the electric arc in combination with air. The new "Arcar", in combination with a Lincoln welder and a Jaeger compressor, succeeded where the other method had failed.



Quick Test for Stainless Steels

A SIMPLE, INEXPENSIVE, and time-saving test to differentiate between the 200 and 300 series stainless steels has been devised by the Union Carbide Metals Co.

Since the two types are similar in appearance, comingled lots, not otherwise identified, are very difficult to segregate. The identification could be made by chemical analysis or by spectroscopy, but such facilities are rarely found in small operations.

Union Carbide's test only concerns itself with the 200 and 300 stainless steels.* The 400 series can easily be picked out of a mixed lot—it is strongly magnetic.

Reagents for the spot test include: hydrochloric acid (regular concentrate), nitric acid (regular concentrate), sodium bismuthate, water, and a glass stirring rod.

Here's the procedure. Place two drops of nitric acid followed by one drop of hydrocloric acid on the specimen to be tested. After the reaction has subsided, add two drops of water and mix with a stirring rod. Add a pinch of sodium bismuthate and mix with the rod. If all the sodium bimuthate dissolves, add small portion until excess reagent is present. After thirty seconds to a minute, the 200 series steels will give a dark reddish-brown spot, while the 300 series will give a tan spot.

The operator should first familiarize himself with the test on known specimens of 200 and 300 stainless steels. On sheet material, a ¼- to ½-in. diameter dimple made with a blunt nose punch confines the area of the test and makes it much easier. The operator can also confine the reaction by drawing a 1-in. circle with a grease pencil.

* All stainless steels have in common a chromium content of more than 11.5%. The 200 series are low-nickel, high-manganese steels. The 300 series contain about 18% chromium and 8% nickel. The 400 series contain plain chromium stainless steels.

B.F.Goodrich

B.F. Goodrich tires carry 44-ton gross loads for strip miner, still can be retreaded twice

J. Robert Bazley, Inc. of Pottsville, Pa., strip mines throughout the anthracite region, also builds roads all over the state. The company operates 217 rubber-tired vehicles working as many as 70 hours a week. The truck above carries 22 tons of rock and dirt overburden. Add the vehicle weight, and you have a 44-ton gross load for those tires to carry over razor-sharp rock!

Yet the tires can be retreaded *twice!* This is possible because the tires are B.F.Goodrich Rock Service tires—specially built for this kind of work. Massive double-chevron cleats defy rock cuts and bruises, pull in forward or reverse. B.F.Goodrich FLEX-RITE NYLON cords withstand double the impact of ordinary materials, resist heat blowouts and flex breaks. Result: this B.F.Goodrich Rock Service tire body outwears even the extra-thick tread, can be retreaded again and again!

Follow the lead of successful strip miners like J. Robert Bazley. Switch to B.F.Goodrich Rock Service tires. You'll be dollars ahead. Your B.F.Goodrich Smileage dealer is listed under Tires in the Yellow Pages of your phone book. See him today. *The B.F.Goodrich Co., Akron 18, Ohio.*

Specify B.F.Goodrich tires when ordering new equipment

Smileage!

B.F.Goodrich *off-the-road tires*

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BALANCED ENGINEERING

keeps trucks on the move

How can you be *sure* of high production? Consider this: *more quarry and mine operators depend on Bucyrus-Erie electric shovels than any other.* Performance on the job proves that they are more rugged, stay on the job longer, require less service and maintenance.

Behind this kind of performance is Bucyrus-Erie *Balanced Engineering* . . . engineering that makes sure that all components are soundly designed, soundly built. The voltage control system is an example. It delivers fast acceleration and deceleration the instant you need it . . . gives you high torque at low speeds, high speeds at low torque . . . and is designed to be *consistently dependable.*

For the complete story on *Balanced Engineering,* write Bucyrus-Erie Company, South Milwaukee, Wisconsin, Dept. 2LB.

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call KE for plant expansion or new facilities

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Ingenuity at work—produces better, faster construction, at lower cost; more efficient and profitable operation.

Ingenuity is a hallmark of Kaiser Engineers—has been for over 40 years of contracting. Experienced KE design and construction engineers can advance your new plant plans from conversation to completion, quickly, at lower cost. Or, they can undertake any single part of a project. One contract can cover all.

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HOW

can trim your

Today, many producers of copper, aluminum and other metals are effecting important economies in manpower costs — *through automation of casting and handling equipment.* We know, because, for a large percentage of the most modern installations, Treadwell has prepared the layout, handled the engineering, and built and installed the equipment.

This same experienced assistance is available to you. Here is how Treadwell can help you.

COPPER SMELTING AND REFINING

Wheels for casting anodes, cakes, billets, ingots, ingot bars and wire bars can be supplied for automatic-stop and manual-start operation, with push-button controlled pouring mechanism, and automatic knockout, conveying, spray-cooling, dressing and mold-making equipment. Automatic turnover mechanisms for cakes and billets, and automatic stackers for anodes, ingots, ingot bars and wire bars can also be furnished. Reverberatory, holding, and melting furnaces, converters, converter up-takes and steel flues, ladles and slag cars are designed to meet individual requirements and are carefully matched in capacity to assure efficient production.

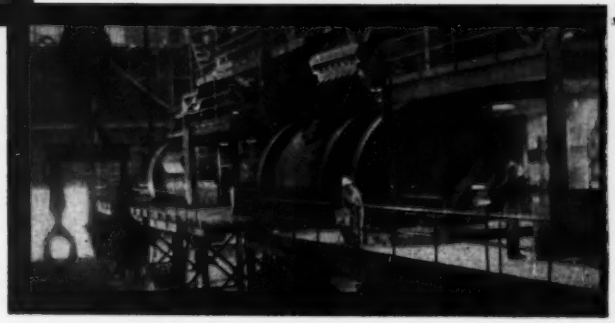
STRAIGHT-LINE ALUMINUM CASTING

Treadwell straight-line aluminum casting machines are built for high-speed, low-cost production. Ingots are poured, stamped, spray cooled and conveyed to a stacking machine—all automatically. The stacker

13'x30' Peirce Smith type copper converters.

Top photo—Wheel for casting copper anodes, furnished by Treadwell, with remotely controlled pouring mechanism, automatic knockout mechanism and anode take-off crane. Cooling, dressing and mold-making equipment also designed and supplied by the company.

Above—38-foot combination casting machine for vertical casting of copper cakes and billets. Shapes are dumped and cooled in the pit at the lower right. Elevating conveyor for delivering cakes to inspection floor is at the far right.



AUTOMATION

costs in smelting and refining

nests the ingots, and places them in rows ready for pickup by a lift truck. The spray conveyor cools the ingots so they can be automatically banded as soon as they are stacked.

OTHER METALS AND ALLOYS

In addition to copper and aluminum, Treadwell has designed and built a wide variety of equipment for the production of other non-ferrous metals and alloys. These include lead, nickel, tin, brass, bronze and zinc, among others.

INTEGRATED SERVICES

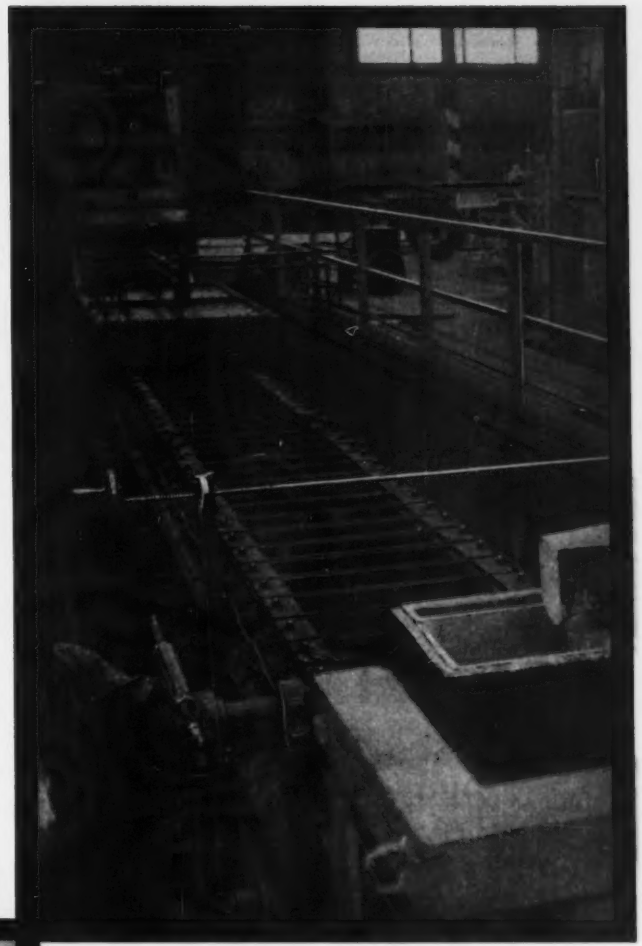
Treadwell is prepared by experience to undertake complete "turnkey jobs"—including plant layouts, design of buildings and other structures, design of foundations, furnishing all equipment, design of piping and power-distribution and materials-handling systems, complete construction and supervising start-up of the plant.

FOR FURTHER INFORMATION

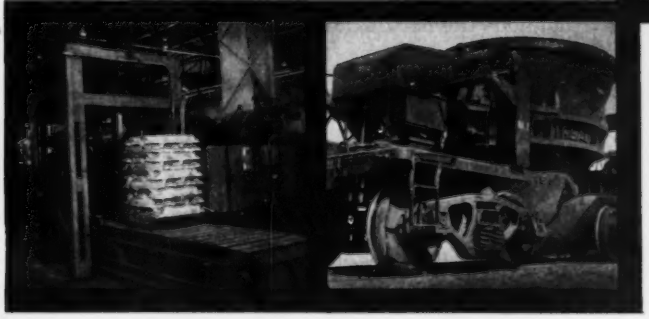
For a preliminary discussion of your requirements, you name the time and place. A Treadwell sales engineer will be there. In the meantime, send for copies of bulletins describing Treadwell's equipment and services.

M. H. TREADWELL COMPANY, INC.
140 Cedar Street, New York 6, N. Y.
1015 Farmers Bank Bldg., Pittsburgh 22, Pa.
208 So. LaSalle St., Chicago 4, Ill.

TR-31



Straight-line aluminum casting machine with automatic stamping device and stacker. Wheels for casting aluminum cakes are also available.



Automatic stacker for aluminum ingots.

225 cubic-foot slag car.

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Engineers
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Constructors

BOULDER BOUNCE won't bruise this screen!

It's Hendrick Skid-Bar Mounted Wedge Slot Screen. The Skid Bars protect the wedge slot screen from large ore chunks. They also reduce wear caused by abrasive action — assure you of a better dewatering job and longer screen life.

Here's an extra plus: CH-12 profile bars on Hendrick Skid-Bar Screens have a thick, parallel head flange which maintains uniform openings throughout the life of the screen.

Hendrick Skid-Bar Screens are fabricated to fit your exact requirements. For further information, write Hendrick today.

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For drifters, sinkers and stopers...

NEW TIMKEN® THREADED BIT CLEARS CHIPS FASTER TO DRILL MORE HOLE-PER-BIT

When you use this new Timken® tapered socket carbide insert bit you drill rock—not chips—because chips clear faster. Its newly positioned 5 front holes jet-propel air or water against the rock face. And deeper, wider wing clearance and deeper relief under the heel help clear the chips extra fast. This quick wash-back ends the problem of clogged drill steels, protects your bit skirts against damage, lets you drill more feet-per-bit.

You get even more hole-per-bit because new special analysis carbides give this new Timken threaded bit greater resistance to shock and wear. And you can recondition it many times. Its redesigned heavier wing speeds drilling. Improved thread contact cuts breakage to a minimum.

For drifters, sinkers and stopers, this new Timken threaded carbide bit is the one to give you more hole-per-bit. For a free brochure that gives all the details write The Timken Roller Bearing Company, Rock Bit Division, Canton 6, Ohio. Cable address: "TIMROSCO".

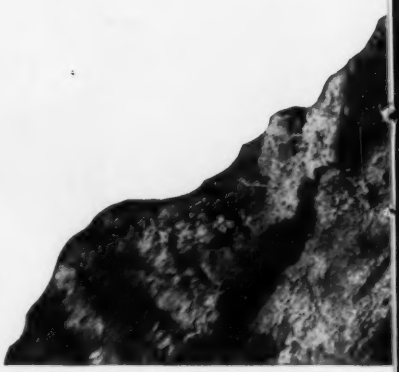
FOR OTHER TOUGH DRILLING JOBS

Improved Timken all steel multi-use bit gives you lowest cost per foot-of-hole—with correct, controlled reconditioning—when you can drill full increments of steel.

New Timken tapered socket bit is removable for full steel life, tapered for more secure union, and has same new frontal features as threaded bit. It's the air-leg bit of the future—here today!

TIMKEN® REMOVABLE ROCK BITS

"We've used International TD-24's on our job continuously for three years," reports Bobby Ikerd, for Ikerd and Bandy, Inc., Manchester, Ky. "Our first '24' has worked over 8,000 hours. We get good production with exceptionally long track life. Live track turning, planetary steering features, combined with hydraulic dozer, gives us a faster stripping operation in mountain terrain—plus operator safety advantages." Their 24's strip 30-foot earth-shale-rock overburden on 100-foot maximum push. Right: One of their "24's" rolling up production!



PLANET POWERED "24's"

hit stripping cost squeeze...with

"Planetary steering enables the TD-24 operator to cut more high-wall yardage per day, as live power on both tracks pulls out full dozer blades on a continuous move," declares Supt. Ken Ellis, Ford Mining Co., Charleston, W. Va. "The decelerator offers better tractor control. Our older TD-24 still has the same track system after 7,000 hours of work. Service like this sold us on our new '24'." To support a coal-augering operation, their TD-24, shown, faces up to 300 lineal feet of bench daily—cutting a maximum depth highwall of 30 feet, in hard shale and sandstone.

"Our year-old '24,' stripping overburden, and working in mud, sand, and gravel along the creek bed, keeps well ahead of the dragline," states Supt. C. G. Hendry, for Dallas Sand and Gravel Co., Inc., Selma, Ala. "Our TD-24 track life (they've owned three '24's') runs a good one-third longer than competitive crawler owners are getting around here." The company produces fluxing gravel, road rock, pea gravel, and sand for industrial and construction uses.

"live" track steering...long track life!

"The TD-24 planetary steering design combined with the torque-converter has greatly reduced tractor maintenance in our type of operation," reports R. D. Baughman Coal Company, Brookville, Pa. "Live power on both tracks enables the operator to push larger loads, always keeping the dirt rolling regardless of terrain conditions. My operators especially like TD-24 ease of control." The Baughman Company strips up to 40 feet of shale, sand rock, and clay overburden from a 5-foot seam of coal.

See what's behind TD-24 ability to outdoze same-sized competitors, as much as 50%—and to give up to one-third greater track life than other makes, especially in tough conditions! See how exclusive Planet Power steering keeps paydirt on the move—doesn't spill your "extra profit" margin—eliminates "dead-track drag" in turns. Prove what it means to increase stripping production efficiency and cut upkeep with "24" capacity. See your International Construction Equipment Distributor for a demonstration.

International® Construction Equipment

International Harvester Co.,
180 North Michigan Ave., Chicago 1, Ill.

A COMPLETE POWER PACKAGE: Crawler and Wheel Tractors... Self-Propelled Scrapers and Bottom Dump Wagons... Crawler and Rubber-Tired Loaders... Off-Highway Haulers... Diesel and Carbureted Engines... Motor Trucks... Farm Tractors and Equipment.

Here's why a NEW 375-hp International® CAN OUT-EARN ANY OTHER BIG

In the new 27 cu. yd. 495 Paywagon®, big earning advantages start with the new International DT-817 diesel engine. Forty-ton payloads highball upgrade or over rough and soft spots faster than ever behind the locomotive-like wallop of 375 turbocharged hp—more power per struck yard than any comparable wagon! Next, the "495" Paywagon's exclusive power-opened clamshell doors give positive dumping control—and retract parallel with hopper sides—"clean as a whistle" from wiper plate action! Pull-away clearance, to straddle 60"-high windrows, eliminates dumping delay! Too, the 495 Paywagon has new full 90° turning in either direction; new road-hugging design to gain top mph safely, out and back, at speeds up to 32.0 mph. Plus exclusive extra operator comfort and control features that reward you with extra production!

In the new 24 cu. yd. 495 Payscraper,® exclusive International DT-817 diesel power earning advantages team up with new cutting width and tapered bowl design—to heap-load faster than any other 3-axle scraper of its size. And it hauls at speeds up to 32.0 mph! The scraper's big 131" cutting width promotes fast dirt break-away, permits both unit and pusher to operate within the cut for best traction. Exclusive tapered bowl design boils dirt toward center, reducing side spillage; permitting positive, forced ejection even of sticky or frozen materials. More hp per struck yard than any competitive unit—wheel and bowl leveling adjustment —custom-designed cable control unit—full 90° turns—all team up to make the 495 Payscraper the top producer of its size class!

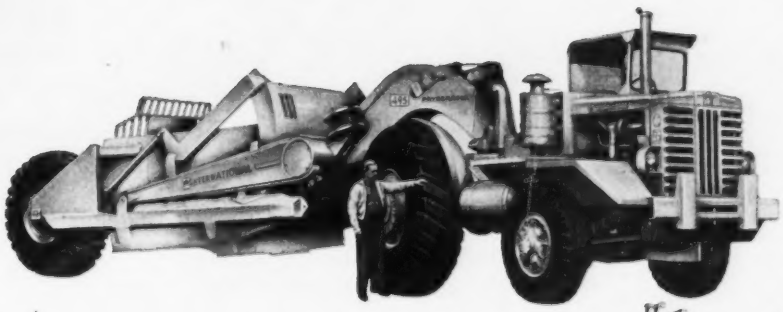
In the new 24 cu. yd. 295 Payscraper—you get the same big-capacity, high-torque engine that powers the 495's: the 375 hp DT-817! You get haul speeds up to 29.1 mph—matched with new automotive comfort and control features, that include a 16-adjustment seat. And the scraper unit of the 2-axle 295 is the same heap-loading, tapered bowl, wide-cut scraper featured in the 495 Payscraper!

Match any new International Earthmover against any similar equipment on your job or in your mind—for capacity, operating ease, low costs and net profit earning ability. See your International Construction Equipment Distributor!

Earthmover

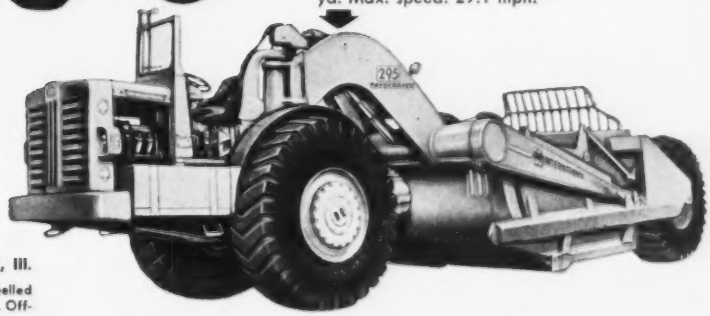
WHEEL RIG ON YOUR JOB!

Heaped, the new 375 hp International Paywagon highballs 40.5 cu. yd. (or 40.5 tons) as fast as 32.0 mph. Choose either 4-speed Power Shift or 9-speed constant mesh transmission drive.



Controlled with new custom-designed cable control unit, the 375 hp International 495 Payscraper speeds 34 cu. yd. heaped loads up to 32.0 mph. Its apron can "gape" open as high as 98"—for sure ejection of all materials!

Positive-acting air brakes—16-adjustment spring hydraulic seat—unobstructed vision—flush-deck safety—power steering—all add up to production-boosting operator comfort and ease of control of the new 375 hp 295 Payscraper. Heaped capacity: 34 cu. yd. Max. speed: 29.1 mph.



International® Construction Equipment

International Harvester Co., 180 North Michigan Ave., Chicago 1, Ill.

A COMPLETE POWER PACKAGE: Crawler and Wheel Tractors . . . Self-Propelled Scrapers and Bottom-Dump Wagons . . . Crawler and Rubber-Tired Loaders . . . Off-Highway Haulers . . . Diesel and Carbureted Engines . . . Motor Trucks . . . Farm Tractors and Equipment.

Can your loader "lift its lip" and duplicate dozer action? No?

Then trade it off without delay! Because you'll miss money-making opportunities right and left without this big-capacity 4-in-1 action. And you have positive "radius control" of dozing depth; plus strength for hard digging! Here, the new International Drott TD-20 4-in-1 is dozing heavy gumbo material like a full-size blade!

Can your loader grade and strip like a carry-type scraper? No?

Then consider what extra service—and extra-valuable service you would have—with versatile scraper-like action at your fingertips with a moderately-priced 4-in-1! This TD-20 4-in-1 is stripping sticky clay. It can also grade or spread materials with similar accuracy.

ONLY A CLAM-ACTION 4-IN-1

can replace up to $100,000 of limited-duty equipment!

Can your loader "bottom-dump" and handle sticky materials? No?

Then retire the "relic" and go modern! You can't choose the materials you excavate. You can't prevent adverse weather that makes materials sticky! But 4-in-1 bottom-dumping eliminates the sticky materials problem and gives you a vital dumping height plus advantage over ordinary roll-forward buckets.

Move the selector lever—prove to yourself only the clam-action 4-in-1 doubles for a whole spread of "big-ticket" rigs—gives instant changeovers. Compare 4-in-1 capacity and versatility to any single-action loader. Measure exclusive shock-swallowing Hydro-Spring advantages. See your International Drott Distributor for a demonstration—prove you can save up to $100,000 on equipment!

Does your loader have measured, advertised breakout action? No?

It's the genuine and exclusive pry-over-shoe breakout action that enables International Drott 4-in-1's to replace far costlier boom-type rigs on jobs like breaking up and loading out hard, heavy stratified or embedded materials. The NEW TD-15 4-in-1 exerts the enormous force of 39,200 lbs!

International Harvester Company, Chicago 1, Illinois
Drott Manufacturing Corp., Milwaukee 15, Wisconsin

INTERNATIONAL® DROTT®

Pounded over 200 times by air hammer . . . still not cut!

Even after steady pounding with an air hammer, which delivered 80 pounds of pressure to the chisel edge, Gold Seal air hose was still intact! Think of how much you will save on costly replacements should your operator accidentally hammer Gold Seal for a few seconds . . . or a trucker dump a load of rock on it . . . or a tractor grinds over it.

A. COVER: Extremely tough, resilient rubber; resists abrasion, cutting and gouging.

B. CARCASS: Braided steel wire for maximum strength and resistance to extreme impacts. Single braid of nylon cord to insure maximum bonding of cover to carcass.

C. TUBE: Synthetic compound to insure maximum oil resistance. Won't soften or flake.

Write Dept. E. for more information.

Acme Hamilton

Serving Industry Since 1870

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CAN KELLOGG'S RESEARCH IN

FLUIDIZATION

IMPROVE YOUR PROCESSING?

Fluidization is a remarkable processing technique whereby powdered solids such as catalysts, ores, and other granular or crystalline materials can be made to flow like fluids and reacted with liquids or gases in a continuous process stream. The M. W. Kellogg Company has made important contributions to this technique.

The practical worth of fluidization is demonstrated twenty-four hours every day in the hundreds of fluid catalyst cracking units used in petroleum refineries all over the world. In many projects, Kellogg has been responsible for both process design and engineering and construction.

Today, fluidization is not limited to petroleum refining. Through Kellogg's continuing program of research, the technique now offers processing improvements and economies in many other areas. Outstanding examples are in the chemical, nuclear, and metallurgical fields—wherever large-scale endothermic or exothermic reactions demand exacting temperature control.

Kellogg's research facilities are at your disposal to help you find satisfactory answers to process problems through fluidization or other advanced techniques. For Kellogg's whole story, write for *"Planning the New Plant for Profits"*. Also ask for a recent Kellogg paper on mineral reactor systems.

THE M. W. KELLOGG COMPANY

711 Third Avenue, New York 17, N. Y. *A subsidiary of Pullman Incorporated*

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YUBA

—first with the best in Custom-built

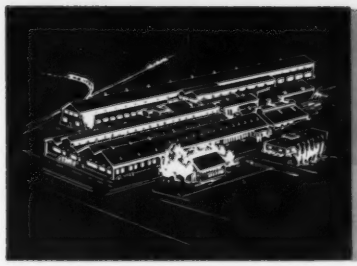
MINING EQUIPMENT

ENGINEERING EXPERIENCE

Yuba engineers are experienced and skilled in all phases of design, detailing, estimating, testing and quality control. Whether you need a Yuba Mineral Jig, a 30" Hydraulic Dredge, or a 54 cu. ft. Bucket Ladder Dredge, Yuba specialists have the training and background to handle the job from design to completion.

OPERATING EXPERIENCE

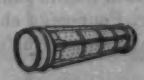
Yuba has carried on major mining operations for over half a century. This experience is invaluable in putting practical working knowledge into the design and building of mining equipment. The result has been a number of exclusive developments now accepted as standard 'round the world.



PRODUCTION EXPERIENCE

Manufacturing facilities are complete, modern, and fully diversified to handle the most complex jobs in engineered machining and fabrication of special alloys, carbons and other metals. Yuba has what it takes to deliver the finest in mining equipment. You'll like doing business with Yuba.

Yuba designs and builds a wide range of equipment for the mining industry, including:



Custom Ore-Handling Equipment

Jigs—Side Diaphragm

"Movell" Earthmovers

Grinding Balls

YUBA MINING DIVISION

675 E. H Street, Benicia, California

YUBA CONSOLIDATED INDUSTRIES, INC.

Kittanning Brick Company's Diesel-powered Plymouth hauls heavy loads of clay from mine to tipple. Mine-O-Motive unit pulls big loads with exceptional economy.

"7-ton PLYMOUTH Hauls 14 Cars Per Trip"

Reports Kittanning Brick Company, Adrian, Pa.

"Using a Plymouth Mine-O-Motive, we can now pull 14 cars or more from our clay working area to the tipple, with a crew of only 2 men," reports the president of Kittanning Brick Company, Adrian, Pa.

"The hauling efficiency provided by our Plymouth Diesel has enabled us to increase our daily clay production—saves us both time and money. Our system has improved employee morale and we always have empty cars to load, which reduces total man-hours per ton.

"Our narrow-gauge Model FMD hauls clay 48-hours a week over a 2-mile route. consumes only ½ gallon of fuel per hour. Four-gear shift enables it to pull a 14-car load over 6% grades with full power at all times."

For full information on a Plymouth designed to fit your haulage needs, send a brief outline of your operations to: The Fate-Root-Heath Company, Dept. A-5, Plymouth, Ohio.

RAIL POWER

PLYMOUTH® LOCOMOTIVES

WITH TORQOMOTIVE DRIVE

PLYMOUTH LOCOMOTIVES in Progressive Industry throughout the world

Specialized chemicals for minerals—from Armour

Armour Chemical offers a wide variety of chemicals for mineral applications—cationic flotation collectors, flocculants, and conditioning agents for hygroscopic materials.

Mineral applications	Recommended Armour Chemical
Flotation: Silica from Phosphate Rock; Mica, Spodumene and Feldspar from pegmatites; Iron-bearing minerals from glass sands; Sylvite from Halite **Bulk flotation:** Heavy minerals from beach sands	Armac T (tallow amine acetate)—a technical grade amine salt between 95% and 102% neutralized. It is a medium-hard solid. At 25°C it can be used as a 5% water solution producing a pH of about 7. At this solution it is also an anti-caker of hygroscopic materials, even when applied to moist surfaces.
Flotation: Silica from Phosphate Rock; Mica, Spodumene and Feldspar from pegmatites; Iron-bearing minerals from glass sands; Sylvite from Halite **Bulk Flotation:** Heavy minerals from beach sands	Armeen T (tallow amine)—a technical grade amine that is a medium-hard solid. It can be used straight when blended with frother or secondary collector (usually 2 parts amine to 1 part solvent). Or it can be used when neutralized with acetic acid or hydrochloric acid and solubilized in water. When heated to its free-flowing temperature, straight Armeen T functions as a conditioning agent for anti-caking hygroscopic salts or formulations.
Flotation: Silica, Mica and Pyrite from Calcite or Kyanite; Silica from Iron Oxides; Monazite from a variety of heavy minerals	Armac C (coco amine acetate)—another technical grade amine salt between 95% and 102% neutralized. This one is a soft and pasty solid that can be used as a 25% water solution at 25°C. Armac C is recommended for applications in which mineral sizing is fine, or where sharp mineral selectivity is desired.
Flotation: Silica, Mica and Pyrite from Calcite or Kyanite; Silica from Iron Oxides; Monazite from a variety of heavy minerals **Flocculant:** Selective flocculant for negatively-charged particles	Duomac T (tallow diamine di-acetate)—a diamine salt, about 100% neutralized, that is a soft and pasty solid. It can be used as a 20% water solution at 25°C. Duomac T is a stronger collector than Armac C and is capable of floating coarser mineral sizes.

Mineral applications	Recommended Armour Chemical
Flotation: Sylvite from Halite	**Armeen TD** (tallow amine, distilled)—the equivalent of Armeen T, but higher in primary amine content and a quite-hard solid. It is neutralized with acetic acid or hydrochloric acid, then solubilized to about a 5% water solution before use.
Flotation: Sylvite from Halite **Conditioner:** Anti-caking agent for Sylvite	**Armeen HTD** (hydrogenated tallow amine, distilled)—a hard, waxy, completely saturated derivative of tallow amine. Less soluble and more inert than Armeen TD. As a collector, it is used as a 1% water solution of the acetate or hydrochloride salt. As a conditioner, it is melted and applied straight.
Flotation: Mica and Feldspar from pegmatites Silica from Phosphate Rock	**Armoflote 54-38 and 58-22** (amines in nitrogen-based solvents)—chemicals to be used straight in flotation circuits, blended with either the frother or secondary collector to aid their dispersion in the pulp. Armoflote 54-38 is liquid at 90°F, Armoflote 58-22 at 60°F.

New product applications for tomorrow

Arquad 2HT and T2C (quaternary ammonium salts).

These two Arquads are effective in specialized flotation or flocculation applications. Both can be used as water dispersions, using 4-5% of the Arquad by weight. They have also been used as 1% solutions in isopropanol.

Flotation applications are recommended with slimy ores or where weak cationic activity is desired. The quantity of chemical needed depends on the condition of the pulp.

RD-2549-F and RD-2461-F cationic formulations—fluid or liquid at room temperatures.

Uses for these chemicals include: anti-caking of hygroscopic minerals, salts or fertilizer formulations such as Sylvite, Rock Salt, Ammonium Sulfate, Ammonium Chloride, Sodium Nitrate and a wide variety of high-analysis mixed or granular fertilizers with 2 or 3 components.

Both RD-2549-F and RD-2461-F can be used straight with a maximum of 1 lb. per ton of material to be treated.

Write us for samples and technical bulletins. Armour's Technical Service Department will also be happy to help you determine the proper chemical for your specific mineral need.

ARMOUR CHEMICAL COMPANY

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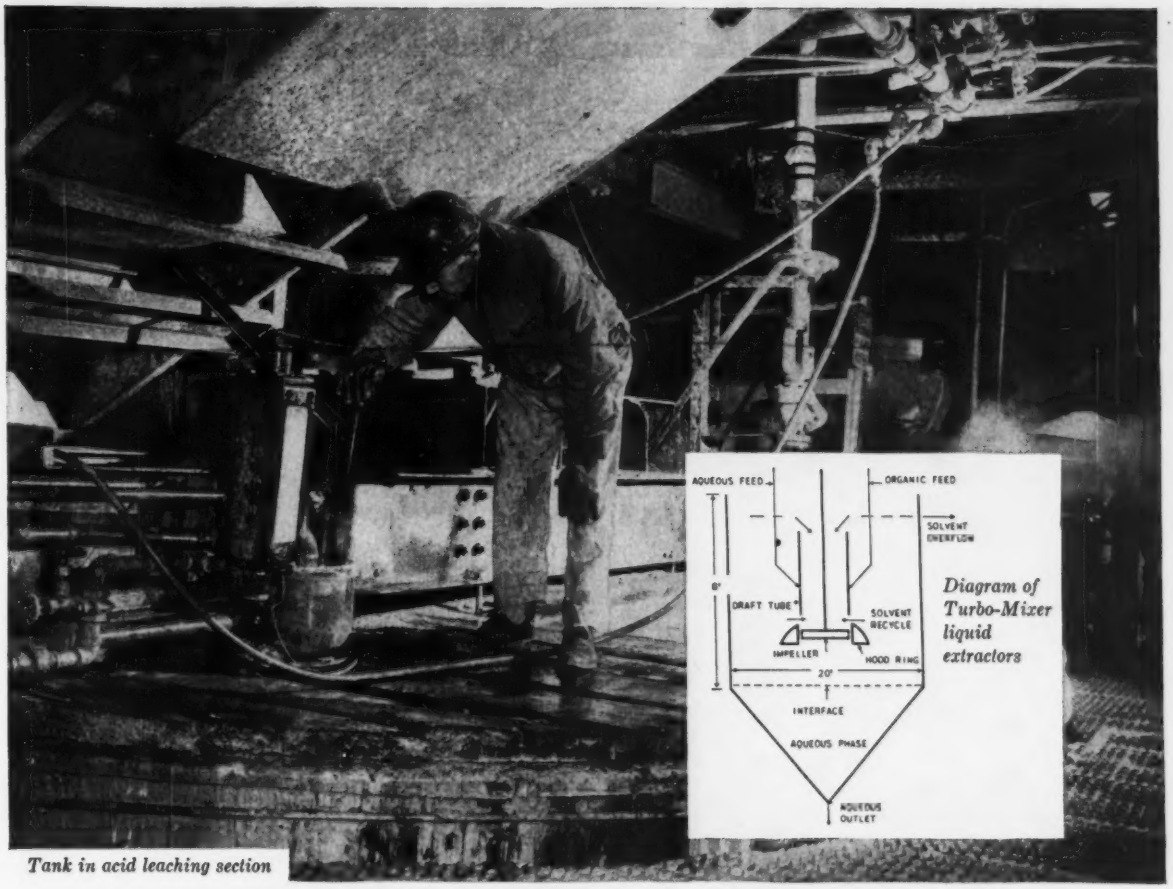

Diagram of Turbo-Mixer liquid extractors

Tank in acid leaching section

VITRO URANIUM HANDLES A WIDE VARIETY OF URANIUM MINERALS WITH TURBO ON THE JOB

When VITRO URANIUM COMPANY of Salt Lake City embarked on a modernization program, they called on GENERAL AMERICAN to assist in the design of the most modern mill possible.

Heart of the plant is the extraction system, and here, GENERAL AMERICAN Turbo-Mixers proved to be key equipment, in both the leaching and liquid extraction sections.

VITRO URANIUM processes a wide variety of uranium minerals which require highly versatile extraction equipment. GENERAL AMERICAN Turbo-Mixers fit this requirement, replacing an outmoded phosphate precipitation operation. Recoveries of uranium fed into the system are "excellent."

As a result of VITRO's million and a half dollar modernization program, the 660 ton/day mill already has significantly reduced operating costs. Further proof that in processing as in transportation and storage, it pays to plan with GENERAL AMERICAN.

PROGRESS THROUGH BETTER TECHNOLOGY

Blue Ribbon Mining Award

TO: **TURBO-MIXER DIVISION**

GENERAL AMERICAN TRANSPORTATION CORPORATION

FROM: **MINING WORLD/ WORLD MINING**

FOR: Achievement In Equipment Development Aiding the Technological Advancement of the Mining Industry.

Write for General TURBO-MIXER BULLETIN

Process Equipment Division

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GENERAL AMERICAN TRANSPORTATION CORPORATION

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HERCULES DIESELS

Preferred Power Underground

Plymouth JDT Locomotive on a New England tunnel job is one of 20 units, all powered by Hercules diesels.

Hercules Engines for Mine Equipment Have Low Ventilation Requirements

KW-Dart 135-UG Shuttle Truck has Hercules DRXC as standard power.

National Mine Diesel TorKars offer Hercules DRXC on Type 60 ED; DOOD on 48 ED.

The compactness, dependability and low ventilation requirements of Hercules diesel designs for mine applications are all important factors in their selection by leading manufacturers of underground engine-powered equipment. And the expanded worldwide network of Hercules service facilities assures owners of Hercules-powered equipment prompt, efficient maintenance—wherever they are.

Write for further information on Hercules diesels for mine service.

SPECIFICATIONS

Model	Displ.	HP
DOOD	255	76.5
DJXH	298	96
DRXC	529	136
TCD	895	260

HERCULES

HERCULES MOTORS CORPORATION
Canton, Ohio

HERCULES ENGINES . . . *Sold and Serviced the World Over*

The more perfectly round a grinding ball is the better it grinds and the longer it lasts—deviations reduce its efficiency. Coates has established a reputation for the roundness of its Carbex Triple-Forged Grinding Balls which dates back to 1918 when they patented a process for the first round grinding ball. Great care and skill are employed in the manufacture of these superior products. More perfect sphericity assures you a ball that wears evenly and grinds better, longer. Continued checks and calibrations throughout the manufacturing process protect the high standards and assure uniformity.

Coates Carbex Grinding Balls are made of fine-grained, high-carbon steel. Scientifically heat treated to the core, they are hard, to last longer and to grind better; tough, to avoid shattering under stress of milling. Call for Coates Triple-Forged Carbex Grinding Balls . . . built with care for longer wear.

C897-9

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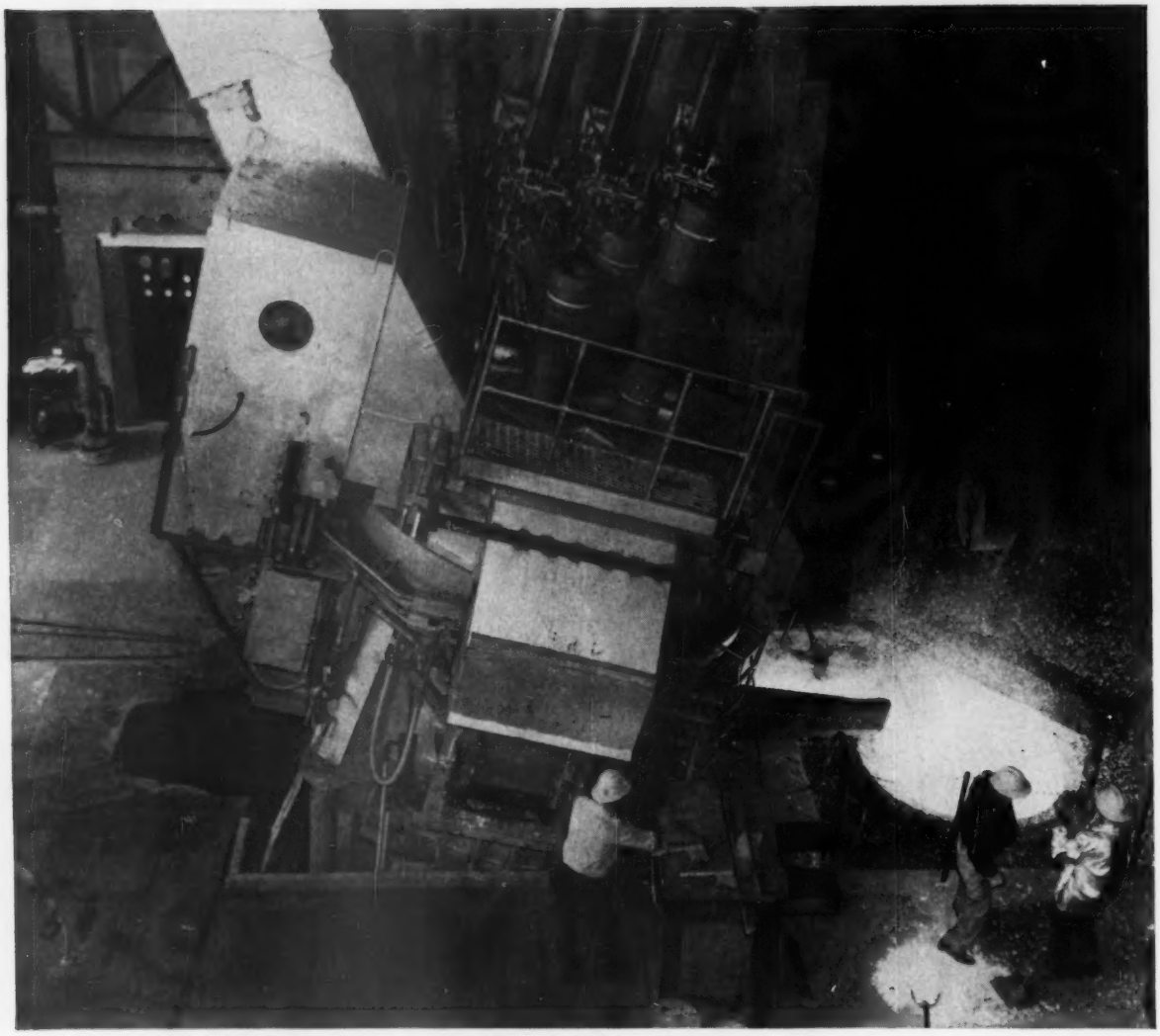
LARGEST EXCLUSIVE MANUFACTURER OF GRINDING MEDIA



RUGGEDNESS...

A MAJOR FACTOR IN THE LOW MAINTENANCE AND HIGH AVAILABILITY OF LECTROMELT FURNACES

When you're selecting an electric furnace, compare design details and you'll note the heavier, sturdier construction that Lectromelt provides. This pays off for you in *service*—Lectromelt furnaces enjoy a world-wide reputation for high availability and low maintenance.

Lectromelt is the world's most experienced builder of electric furnaces. Whether your needs are for 200-pound or 200-ton capacities, it will pay you to get Lectromelt's recommendations when planning additions or replacements. Catalog 10 contains full information.

Lectromelt Furnace Division, McGraw-Edison Company, 322 32nd Street, Pittsburgh 30, Pennsylvania.

FOR THE MOST DEPENDABLE MELTING **Lectromelt®** McGRAW EDISON

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STRONG as steel pipe

...at one-eighth the weight!

Circumferential Tensile Strength... 80,000 psi

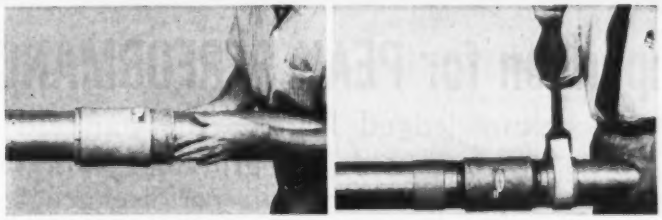
BONDSTRAND®

the revolutionary fiber glass reinforced epoxy pipe for corrosive service

114

Here's a pipe that holds up indefinitely under the corrosive action of many salt, acid and alkaline solutions... that can't contaminate or flavor the piped material... that is rigid enough to resist sag, cold flow or deformation – flexible enough to follow normal ditch contours... that remains smooth and unclogged throughout its entire service life... that won't leak, even near its burst pressure.

Easy to install, with choice of locking wedge or threaded fittings.



Simple instructions with each shipment insure a perfect joint on the first try.

IN THE MINING INDUSTRY...

Because BONDSTRAND pipe is light in weight, nonconductive, nonsparkling and corrosion resistant inside and out, it is ideally suited for mining operations. It is suggested for lines carrying fresh water, mine water and compressed air; and for air ducts, especially where oxidized sulfides are involved. Other uses include transport lines in plants which chemically treat ore, and pumping lines between leaching tanks, clarifiers, precipitation tanks and similar equipment.

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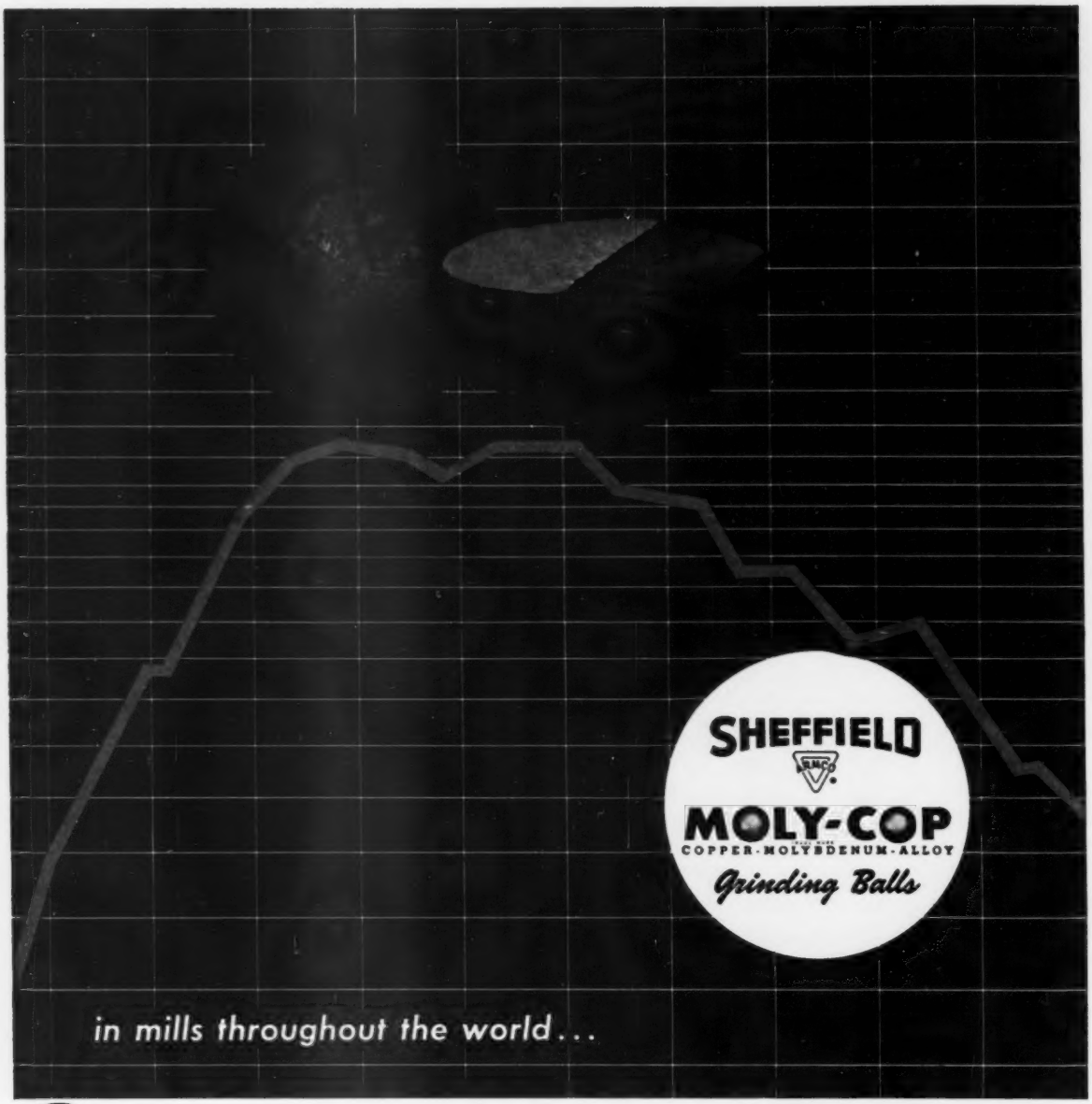
A Subsidiary of American Pipe & Construction Company



The Standard of Comparison for PEAK PERFORMANCE

In every product field there's an acknowledged leader—the standard of comparison against which all others are measured. In grinding balls, that standard of quality is Sheffield Moly-Cop. The reason: in performance tests by mill after mill, Moly-Cops give longer service, less down-time, and other production economies.

New steels are born at Armco

SHEFFIELD DIVISION

ARMCO STEEL CORPORATION

OTHER DIVISIONS AND SUBSIDIARIES: Armco Division • The National Supply Company • Armco Drainage & Metal Products, Inc. • The Armco International Corporation • Union Wire Rope Corporation • Southwest Steel Products

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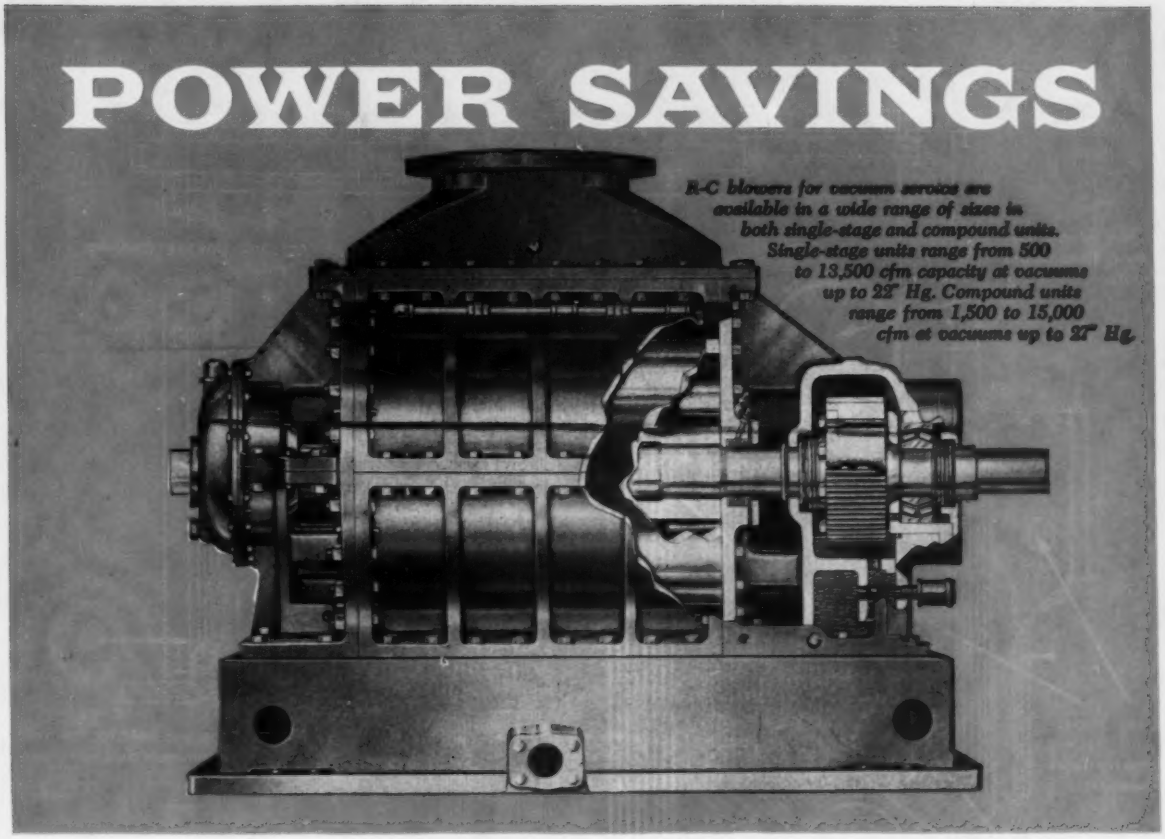

R-C blowers for vacuum service are available in a wide range of sizes in both single-stage and compound units. Single-stage units range from 500 to 13,500 cfm capacity at vacuums up to 27" Hg. Compound units range from 1,500 to 15,000 cfm at vacuums up to 27" Hg.

...up to 25% with R-C Cycloidal Blowers for Vacuum Service

Because R-C cycloidal blowers for vacuum service operate at higher speeds with reduced horsepower, power savings of as much as 25% are often possible. Their simple design and rugged construction assure superior performance, low maintenance and long life. These advantages derive from the high volumetric efficiency of the design, low mechanical friction and installation flexibility. Minimum sealing water effectively overcomes slippage loss . . . as little as 4 gpm may be required.

R-C blowers for vacuum service are used throughout the world in a large number of industries. In chemical processing, R-C blowers have many applications in the handling of nitrogen, hydrogen, acetylene, moist air with SO^2, and other oil and gas mixtures. In paper-making, R-C blowers supply vacuum for suction rolls. In mining, R-C blowers provide vacuum for flotation, filtration and other ore processing requirements. And throughout general industry, they are used for carburetor testing, pneumatic conveying, food processing, cigarette tipping machines, aircraft component testing and many other applications.

Only Roots-Connersville vacuum equipment offers so many advantages – exclusive rotary positive design, ease of installation, efficiency of operation, and long years of trouble-free service. These features are the result of R-C's specialized experience of more than 100 years in the design and application of air and gas handling equipment.

For additional data, please refer to pages 565-568 in **CHEMICAL ENGINEERING CATALOG,** *our section in* **MECHANICAL CATALOG** *or write for* **Bulletin VP-158.**

ROOTS-CONNERSVILLE BLOWER
DIVISION OF DRESSER INDUSTRIES, INC.
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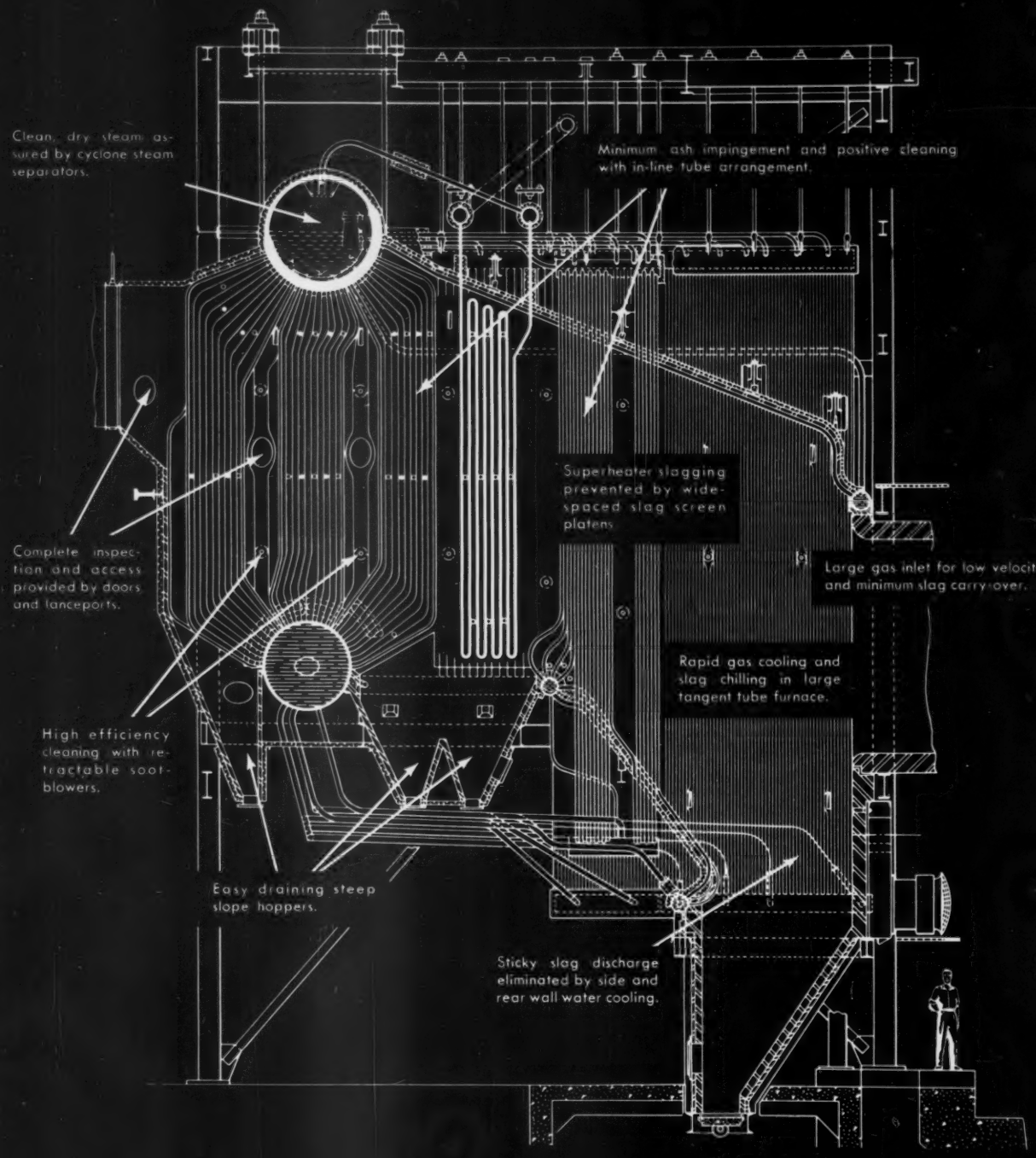
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Rapid gas cooling and slag chilling in large tangent tube furnace.
High efficiency cleaning with retractable soot-blowers.
Easy draining steep slope hoppers.
Sticky slag discharge eliminated by side and rear wall water cooling.

These important design features assure trouble-free, continuous operation of this B&W Waste Heat Boiler

Empresa Nacional de Fundiciones, Paipote, Chile, uses this B&W Waste Heat Recovery Boiler to produce 42,500 lb steam per hour at 400 psig and 700 F at the superheater outlet.

HOW TO SOLVE WASTE HEAT BOILER PROBLEMS

B&W heat recovery system ends production bottleneck

A major problem in waste heat boiler operation is the fouling of steam generating surfaces by slag and ash from the process. Frequent outages and excessive labor for boiler cleaning add substantially to the cost of any plant operation. Production delays can result in further serious losses.

For example, the Empresa Nacional de Fundiciones copper smelter at Paipote, Chile was experiencing difficulty in handling high temperature corrosive gases with considerable slag and metallics carry-over. Slagging of boiler surfaces was severely limiting plant production. Unscheduled smelter shutdowns resulted in excessive refractory maintenance, high operating costs, and production losses.

B&W's engineers were asked to design a boiler to provide trouble-free operation for these difficult ash and slag conditions. An important requirement was that the new system be installed without interrupting plant operation. Utilizing the extensive experience gained from similar installations, B&W recommended a special, single pass, low draft loss boiler for the specific plant conditions at Paipote. B&W's recommendations for a completely engineered system were accepted and a waste heat boiler, flues, dust handling equipment, and auxiliaries were furnished.

The successful elimination of the waste heat handling problems, previously limiting production and causing high maintenance costs, has now been proved by several months of operation. In fact, plant production is now above design capacity.

B&W's extensive research and engineering facilities, plus its broad field experience in design and operating requirements in the metallurgical process industry, are available to solve your problems. The Babcock & Wilcox Company, Boiler Division, Barberton, Ohio.

Send for this Free Definitive Bulletin — G-88 — Today

ME-100

B&W

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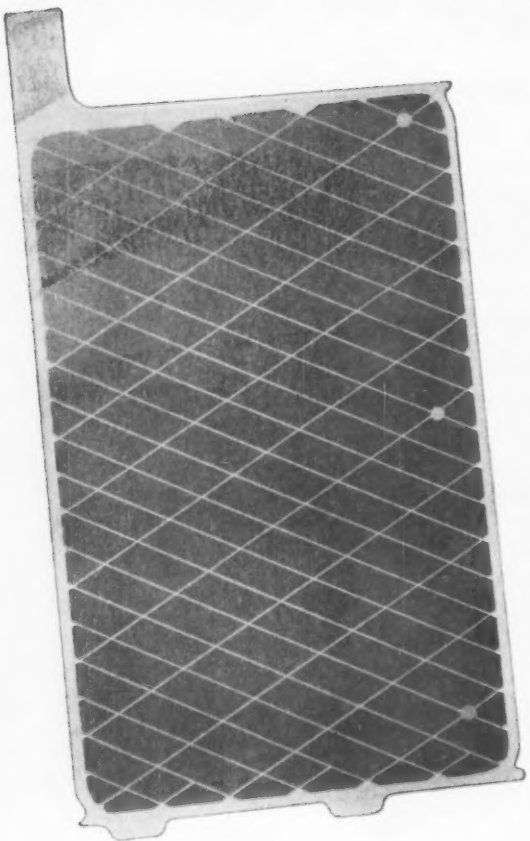
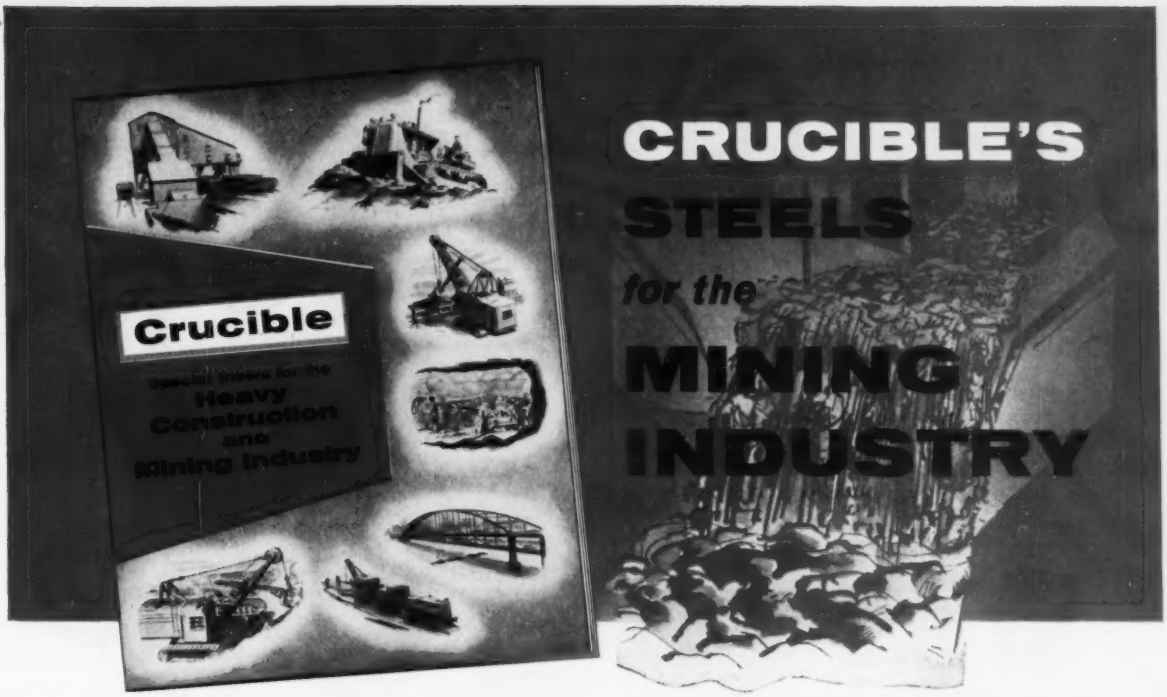


A vital contribution to motive power batteries, Gould's NEW Silconic Plate prevents grid corrosion, the most common cause of battery failure.

Sound, tested and proved, the principle is simply this: Gould introduces silver and cobalt into active materials of the positive plates. The silver and cobalt migrate to—and collect on—positive grid members, forming an insoluble oxide surface impervious to acid and oxygen attack. The longer the battery operates, the deeper the silver-cobalt penetrates into the grid metal, thus greatly prolonging life. In applications where batteries are idle for periods of time, Gould's Silconic Plate prevents migration of materials to the negative plate, effectively reducing self-discharge within the cell.

Further overall strength is achieved when arsenic is added to the antimonial alloy of the plate, resulting in an extremely dense, homogeneous grid free of flaws. This new physical and chemical strength—together with Gould's compact battery design—add up to the best motive power battery you can buy. Write today or call your local Gould representative. He's listed under "Batteries Industrial" in the yellow pages. Gould-National Batteries, Inc., Trenton 7, N. J.

More Power to you from **gould**



This new book tells the story of how and where Crucible's special products solve fabrication and service problems for the mining industry.

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Crucible drill steel is available for any drilling job—both carbon and alloy grades—and in a full range of sizes and shapes.

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Crusca Hollow Drill Steel is the popular straight-carbon type—standard throughout the world. It's an easy to work with, all-purpose drill steel for jobs not requiring the tougher alloy grades.

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Welding electrodes and hard surfacing welding rods for . . .

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Heat and corrosion resistant stainless in all grades, types, and mill forms for . . .

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Hot wound coil springs for crushers, locomotives and cars, vibrating screens and conveying equipment, rock drills, earth moving equipment.

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AMERICAN HOIST & DERRICK COMPANY
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Manufacturers of Crosby Clips and "Load-Rated" Blocks . . . Crosby-Laughlin "Load-Rated" Fittings . . . Lebus Load Binders and Snatchblocks.

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Now...at no increase in price

40% more HP...longer service life

with Gates Vulco Ropes

Gates brings you, through *Specialized* Research in V-Belts, another important cost-saving advance:

Now — at no increase in price — the horsepower rating of Gates Vulco Ropes has been increased 40%.

As replacements on standard drives, these V-Belts with 40% more load carrying ability will give longer service. Longer life reduces down-time, and cuts belt replacement costs.

And as the tag tells you: Belts labeled "Gates Vulco Rope" or "Gates Hi-Power" are identical in construction and can be used interchangeably in matched sets.

Available Now
from your nearby Gates Distributor

Today, all Vulco Ropes in Gates distributor and warehouse stocks have the new higher horsepower rating.

See the Yellow Pages of your phone book for your nearest Gates V-Belt distributor.

Designing NEW Drives?

For new drives, Gates now offers you the *new Super HC V-Belts and Sheaves* — the most advanced concept in power transmission in 25 years. The Super HC Drive is far more compact . . . takes up to 50% less space. Costs less, too. You save as much as 20% over present V-Belt drives. Ask your nearby Gates distributor for Handbook DH-900 entitled, "The Modern Way to Design V-Belt Drives."

The Gates Rubber Company Denver, Colorado
Gates Rubber of Canada Ltd., Brantford, Ontario

Gates
World's Largest Maker of V-Belts

TPA-412

Gates VULCO ROPE Hi-Power V-Belts

What's proper Victor alloy for your

HARDFACING NEEDS?

This chart gives you quick answer. Use it to select right rods for prolonging operating life of your equipment. You'll be selecting rods that go on quickly and smoothly, thereby saving labor and downtime. Order from your Victor dealer today.

FREE For more detailed information on how to apply Victor hardfacing alloys to wearing parts, write us NOW for your copy of Victor Hardfacing Manual.

VICTOR EQUIPMENT COMPANY

Alloy Rod & Metal Division

13808 E. Imperial Highway, Norwalk, California . . . . Wakita, Oklahoma

Profitable dealerships open; inquire now!

VICTOR for hardfacing

H-60

RODS FOR MANUAL APPLICATION

This Hardfacing Rod	For These Conditions	This Equipment or use	How Applied
VICTORTUBE (Tungsten Carbide)	Severest abrasion	Earth cutting, scraping, drilling tools, rippers, augers, ditchers, excavators, loaders	Gas AC-DC Arc
VICTORTUBE (TC) Bare 30-Down	Severest abrasion; moderate impact	Agricultural and earthworking tools. Suitable for acetylene application	Gas only
VICTORTUBE "SPECIAL" (Tungsten Carbide)	Severe abrasion with impact	Oil field tools - rock bits, drag bits, reamers; water well drilling tools	Gas only
VICTOR TUNGSMOOTH (Tungsten Carbide)	Maximum abrasion	Edged cutting tools - bits, blades, farm tools. Smooth, thin deposits on augers, screw flights, paddles.	Gas AC-DC Arc
VICTORITE	High abrasion; sliding friction	Earthmoving and agricultural tools, brick augers, conveyors, mill guides	Gas AC-DC Arc
TUBE VICTORITE	Abrasion and impact	Farm tools, crushers, grinders, mixers, scrapers, fan and screw conveyors	Gas AC-DC Arc
VICTORITE 1	Heat; abrasion, corrosion	Chemical & food machinery, cement pumps, brick dies, dry bearings & journals, expellers	Gas AC-DC Arc
VICTORITE 6	Heat; impact; corrosion; abrasion	Hot dies, stripper bits, exhaust valves & seats, dry bearings & journals, edging rolls, cams	Gas AC-DC Arc
VICTORITE 12	Heat; corrosion; abrasion; impact	Saw-blade inserts, shaft bearings, hot punches, flapper valves, needle valves	Gas AC-DC Arc
VICTORITE CARBON ARC	High abrasion; sliding friction	Farm tools, earth abrasion. Applied by gas. Deposits are exceptionally smooth.	Carbon Arc Gas
VICTORITE Plow Point Bar	High abrasion; sliding friction	Cast-to-shape, weld-on cutting edge for plow shares, digger teeth, pilot bits	Gas
VICTORALLOY	Severe impact; abrasion	Crusher & dredge parts, tamper feet, bucket teeth. A tough low-cost hardfacing.	Gas AC-DC Arc
VICTORALLOY #1	High abrasion; medium impact	Crushers, bucket lips & teeth, muller tires, dozer blades, dredge pumps	Gas AC-DC Arc
VICTORALLOY "A"	Angular shock; extreme impact	Clutch parts, gears, latches, pins & keepers; build-up for hardfacing	AC-DC Arc only
VICTORALLOY "B"	Heavy impact; moderate abrasion	Tractor idlers, sprockets, rolls, crusher parts, pump casings, impellers, liners	AC-DC Arc only
VICTORALLOY "C"	High abrasion; moderate impact	Cement screws, gudgeons, drag chains, pressure rolls, mixer blades & paddles	AC-DC Arc only
VICTOR MULTI-PASS (for Build-Up)	Severe impact; compression	Drill tools, crawler pads, crushers, mine rails; build-up for hardfacing	AC-DC Arc only
VICTOR Ni-Mn (for Build-Up)	Severe impact; compression	Hardmetal underbase for manganese steel parts on crushers, dredges, dippers	AC-DC Arc only
VICTOR Ni-Mn (for Attachment)	Severe impact	A low-cost "stainless" joining rod for crushers, dippers, crawlers, dredges	AC-DC Arc only

WIRES FOR AUTOMATIC & SEMI-AUTOMATIC APPLICATION

This Wire	For These Conditions	This equipment or use
VA O	Severe abrasion; moderate impact	Crushers of all types, tool joints, mullers
VA 1X	Abrasion & compression with impact	Scrapers, bucket teeth, crushers
VA 2X	Severe compression & impact with abrasion	Steel mill rolls, dredge rolls, cable sheaves
VA 3	Severe abrasion & compression with impact	Mill guides, crushers, grinders
VA 4X	Severe impact & compression	Build-up on trunnions, tractor idlers & tracks
VA 5X	Severe metal-to-metal impact & abrasion	Shovel rollers, tractor rollers & idlers
VA 6X	Severe impact, high temp., dry bearing	Steel mill rolls, clutches, roll necks
VA 7X	Severe impact & compression with abrasion	Build-up on mine car wheels & tractor rollers
VA 8X	Earthworking abrasion & impact	Dozer blades, scraper blades, tool joints
VA 10	Extremely severe abrasion; moderate impact	Tool joints, crushers, scrapers, swing hammers
VT 60 (Tungsten Carbide)	Maximum abrasion; earth cutting, scraping	Tool joints, scraper blades, augers
Ni-Mn (Hadfield)	Wear, all types manganese steels	Build-up manganese steel parts for overlay or to size

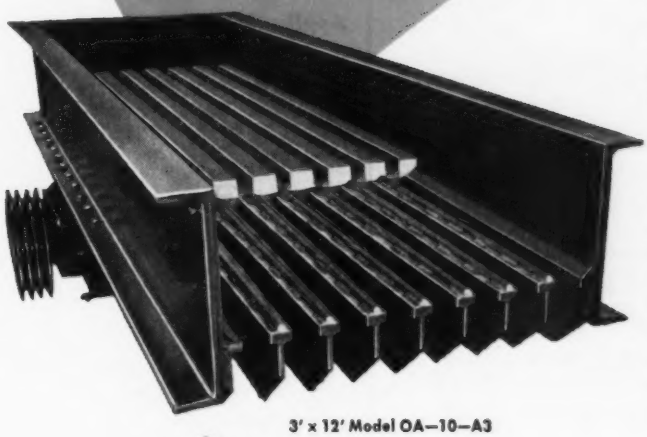
SIMPLICITY

GRIZZLY FEEDER

eliminates need of apron feeder and scalper . . .

3' x 10' Model OA—10—A3

Rock can't jam . . . hourly operating costs lowered



3' x 12' Model OA—10—A3

The unique design of the Simplicity Grizzly Feeder, which combines feeding and scalping in one operation, eliminates rock jams thus assuring positive uniform flow of material into the crusher.

One operator of a Simplicity Grizzly Feeder says: "... we have used the heaviest type of apron feeders for years and have found it necessary to shut down at least 2 or 3 times a year to hard surface the flights, inasmuch as our material is so abrasive ... we installed a Simplicity (Grizzly) Feeder ... with 1/4" pan and 3/16" liner ... and are glad to report that, AFTER 9 MONTHS OF CONTINUOUS OPERATION, THE FEEDER PAN SHOWS PRACTICALLY NO WEAR WHATSOEVER, and is operating around the clock doing an excellent job of feeding at all times ..."

The Grizzly Feeder costs less than 50% of the combined apron feeder and scalper ... weighs considerably less ... makes a more compact plant ... and reduces loading height by several feet. While these factors show up so prominently in portable plant production, they are just as effective in a permanent plant installation for the crushed stone, sand and gravel and mining industries.

214

Send for Catalog #571 for complete information on OS-A-VEYOR and GRIZZLY FEEDERS.

SALES REPRESENTATIVES IN ALL PARTS OF THE U. S. A.
FOR CANADA: Simplicity Materials Handling Limited, Guelph, Ontario
FOR EXPORT: Brown & Sites, 50 Church Street, New York 7, New York

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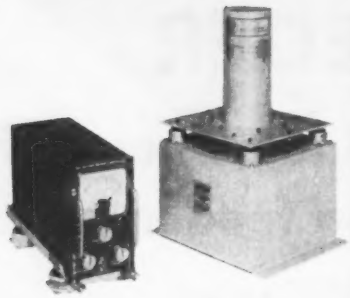
ENGINEERING COMPANY • DURAND MICHIGAN

Precision Instruments for the Mining Industry



AIRBORNE-CARBORNE SCINTILLATION COUNTER

Model 101

Applications

Geophysical exploration for radioactive ore bodies

Geologic mapping

Distinctive Features

Sensitivity increases possibility of a discovery

Permits operation at higher altitude, thus increases safety

Latest circuit techniques and components increase sensitivity, precision, stability and durability

Specifications

Ranges: 100/200/500/1000/ 2000/5000/10,000/20,000 counts per second

Zero Displacements: 0.5 and 1.0 times full scale

Time Constants: 0.2/0.5/1 and 5 seconds

Ratemeter Sensitivity: 10 millivolts

Pulse-Pair Resolution: 2 microseconds

Linearity: 3% of full scale on any range

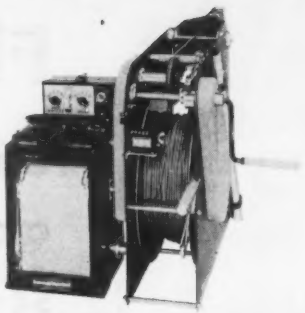
Power Requirements: 3 amperes at 12 volts

Alarm System: Audible—may be preset to operate at any percent of full scale

Recorder: Optional Equipment

Weight: Amplifier-Ratemeter—9 lbs., 5" x 2" detector—19 lbs. (The above weights include the shock-mounts.)

Size: Amplifier-Ratemeter—5" W x 7⅞" H x 12" L—5" detector—10" W x 18" H x 12¼" L.



URANIUM LOGGING UNIT

Model 220

Applications

Quantitative grade-thickness determinations for Uranium ore-body evaluations.

Distinctive Features

Dead-time of probe and circuitry is independent of count-rate. Rate-meter circuit has high degree of linearity and calibration is in counts per second. These characteristics make the Model 220 an excellent instrument for the "Integral Method" of ore-body evaluation, the method accepted by the U. S. Atomic Energy Commission.

Transistorized circuitry is stabilized against changes in ambient temperature.

Geiger probe and cable head are water tight.

Specifications

Probe: L 32 inches, W 3¾ lbs., Diameter ⅞ inches

Recorder: Weight (with counter): 34 lbs. Size (Max. over-all including counter): Height: 16½ inches, Width: 10½ inches, Length: 12 inches

Chart Scale Factors: 1 major division per 5 or 10 ft. of probe travel; 1 minor division per 3" or 6".

TRANSMISSION TYPE FLUORIMETER

Model 500

Applications

Geochemical prospecting

Uranium ore assay

Control in processing and milling

Uranium waste disposal investigations

Urinalysis for uranium

Distinctive Features

Direct reading

Digital dial read-out

High sensitivity

Excellent linearity

High resolution

Self-contained and compact

Low background

Recessed calibration controls

Damage proof galvanometer

Regulated U-V source

Specifications

Range: From less than 10^{-9} grams to 10^{-5} grams of Uranium.

Write for complete information

BALL BROTHERS RESEARCH CORPORATION

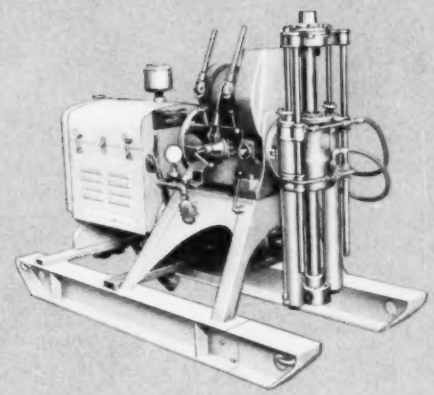
BOULDER, COLORADO

CORE DRILLING MACHINES

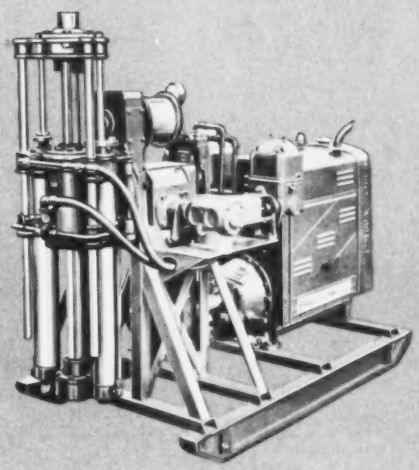
SPRAGUE & HENWOOD

OFFERS YOU . . .

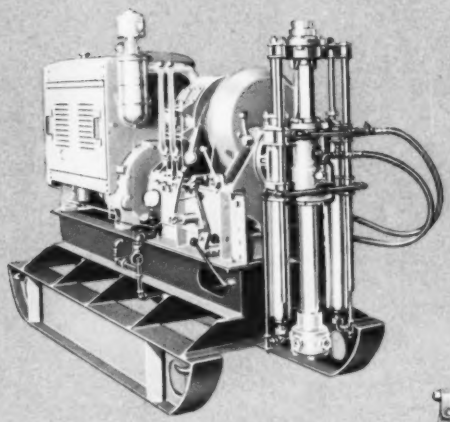
- A wide variety of machines with a choice of swivel-head sizes and types; a choice of skid, trailer or truck mountings; and a choice of gasoline, diesel, electric or air power.
- A quality product designed by an organization having over 75 years of core drilling experience.
- A willingness to work with you, the customer, in developing the machines and equipment most suited to your requirements.



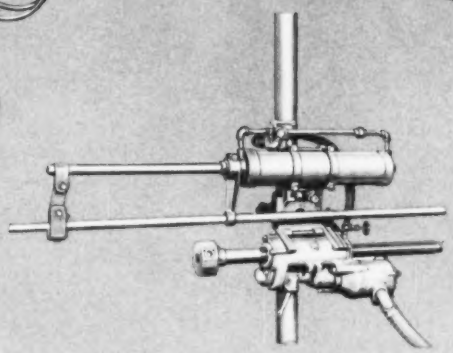
Sprague & Henwood Model 40-CL gasoline-engine-driven core drilling machine with built-in oil circulating system and hydraulic swivelhead. Bulletin #185-2.



Sprague & Henwood Model 30 Water-Cooled Gasoline Engine Driven Core Drilling Machine with a double hydraulic swivel-head. Built-in water pump (optional). Bulletin #350.



Sprague & Henwood Model 142 Diesel-Engine-Driven Core Drilling Machine, with built-in oil circulating system and hydraulic swivelhead. Bulletin #160.



Model CP-55, CP-55-A, and CP-65 Air operated machines for diamond core drilling underground. Driven by vane type air motors, all of these modern machines have ample capacity for fast, steady operation. An air rod puller is available as optional equipment.

NOTE: All models of core drills except underground machines can be furnished with gasoline, diesel, electric, or air power units.

SPRAGUE & HENWOOD, Inc.

SCRANTON 2, PA.

S&H SINCE 1883

BRANCH OFFICES: New York . . . Philadelphia . . . Pittsburgh . . . Atlanta . . . Grand Junction, Colorado . . . Buchans, Newfoundland

EXPORT SALES: SPRAGUE & HENWOOD INTERNATIONAL CORPORATION, 11 WEST 42ND STREET, NEW YORK, N. Y.

"ORIENTED" DIAMOND BITS
AUXILIARY EQUIPMENT
•
SPRAGUE & HENWOOD

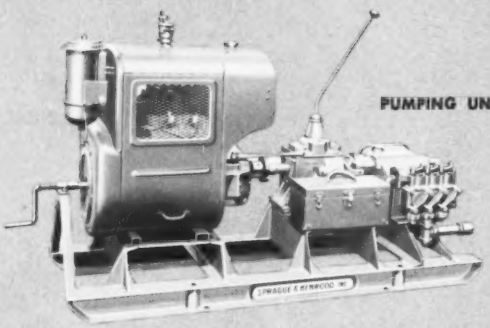
• When you order a diamond bit, you want—and you deserve—only the very best. For many years we have emphasized the importance of tailoring bits to fit individual circumstances. If you send us detailed information on your drilling conditions, we will do our best to develop the bit best suited to your requirements out of the thousands of available styles and types. When you think of diamond bits, think of Sprague & Henwood "Oriented."

"ORIENTED" DIAMOND CORING BIT

Available in four different matrices, two of which are cast and two powdered metal. There are three grades of correctly-sized diamonds. EX, AX, BX and NX sizes are carried in stock. Larger sizes and special designs can be furnished to meet any specifications or requirements.

NON-CORING BITS

Where no core is required, i.e. blast holes, roof and anchor bolting, pressure grouting, gas relief, etc., you cannot beat an S&H Non-Coring Diamond Bit. Three types are available: taper . . . pilot . . . concave.



PUMPING UNITS

The illustrated unit is the S&H Model 20B1240. This unit incorporates a ceramic-lined triplex pump, capable of 20 GPM at 350 PSI, a four-speed transmission, and an air-cooled gasoline engine. S&H pumping units are available in varying sizes and with a wide choice of power units and types of drive.

"ORIENTED" DIAMOND CASING BITS & SHOES

Available in all standard sizes with a choice of four different matrices and three different grades of selected diamonds. Bits of larger size and special design furnished as required. Casing bits must be removed before continuing to drill with core barrel and bit, while casing shoes can be left on the end of the casing at the bottom of the hole while drilling is continued.

"M" SERIES "ORIENTED" DIAMOND CORING BIT

For use with "M" Series Core Barrel, when good cores must be secured from soft or friable strata. Available in all four types of matrix and three grades of diamonds. Also available in a complete range of impregnated sizes. EX, AX, BX and NX sizes carried in stock.

WRITE FOR DIAMOND BIT BULLETIN # 320-1

AUXILIARY EQUIPMENT

Sprague & Henwood's complete line of auxiliary equipment is manufactured with emphasis on the high quality necessary for long life and dependable service. For deep-hole drilling there is none better!

The hundreds of items of auxiliary equipment are illustrated and described in detail in Bulletin #400. Write for your copy.

OTHER EQUIPMENT

SOIL SAMPLERS—Although normally used in foundation work, S&H samplers have often been valuable tools in securing samples of mineral-laden sands and soils. Write for Bulletin #300.

GROUTING EQUIPMENT—Many times stabilization problems have been solved through the use of Sprague & Henwood's complete line of grouting equipment. Write for detailed information and specifications.

SPRAGUE & HENWOOD, Inc.
SCRANTON 2, PA.

S&H SINCE 1867

BRANCH OFFICES: New York . . . Philadelphia . . . Pittsburgh . . . Atlanta . . . Grand Junction, Colorado . . . Buchans, Newfoundland

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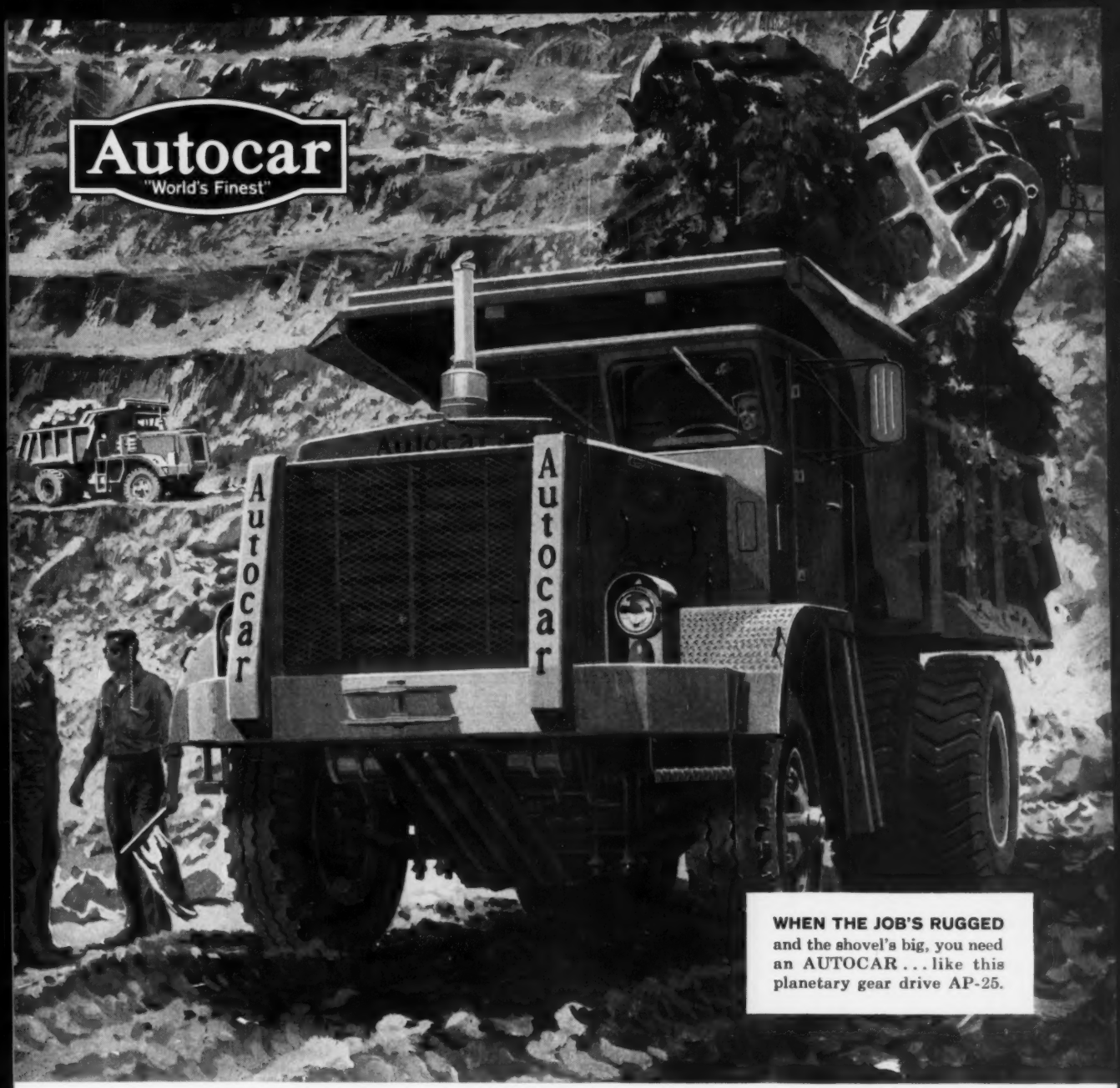

WHEN THE JOB'S RUGGED and the shovel's big, you need an AUTOCAR . . . like this planetary gear drive AP-25.

The BIG loads call for Autocar . . . nothing less

This Autocar AP-25 is a brute. Watch it take the avalanche dropped from a big shovel—or come out of a hole hauling peak tonnage. You'll see *proof* that it's built for big payloads and fast trip cycles.

Reinforced box frame. Exceptional ground clearance. High maneuverability. Plenty of power at the wheels—thanks to planetary gear drive. *All* of these outstanding features account for the AP-25's remarkable performance. Unequaled cab design virtually eliminates profit-slashing driver fatigue.

No matter what the weather or how tough the going, Autocars work harder, longer because there's no compromise in building an Autocar . . . *every* component is selected to form a balanced unit which is custom engineered to *your* operation.

Why settle for less than Autocar . . . "World's Finest."

Autocar
"World's Finest"

Division of
The White Motor Company
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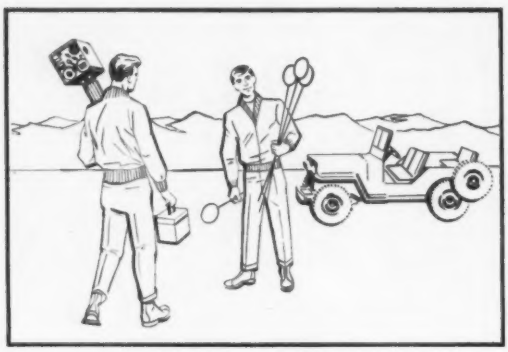
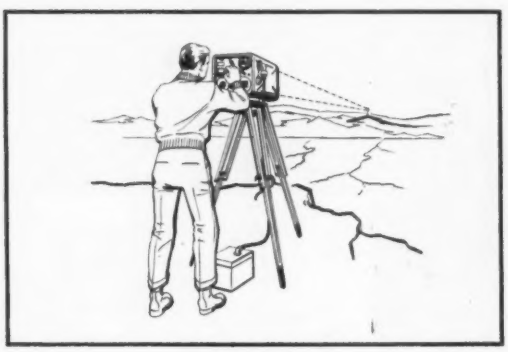
ELECTRONIC SPEED IN MEASURING DISTANCES

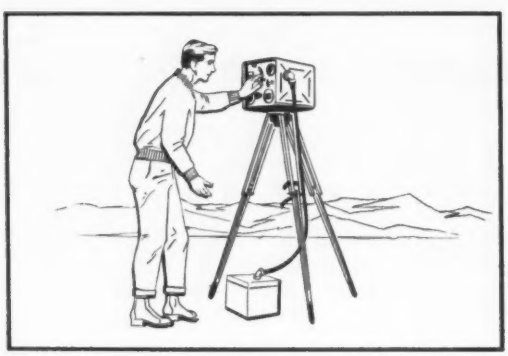
EASILY PORTABLE!



EASY TO TRANSPORT



RAPID SET-UP



MEASURES DISTANCES WITH ELECTRONIC SPEED AND ACCURACY

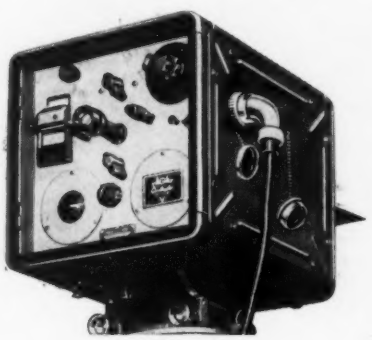
The Geodimeter® Model 4 represents the most recent advance in electronic distance measuring equipment for surveying.

Only 12-inches square and weighing 35-pounds, the instrument with power supply and all associated equipment is easily carried, located and moved about the surveying project.

Not only is the Model 4 smaller, lighter and more compact than Geodimeter Models 2 and 3, but its accuracy and time-saving characteristics are unequalled within ranges of 50-feet to 3-miles. It is fully capable for use as a first order instrument.

In most instances, one man and the Geodimeter Model 4 can complete either routine or difficult surveys in a small fraction of the time required by other means.

Write for full information on the Geodimeter Model 4.



The GEODIMETER Co.

A DIVISION OF BERG, HEDSTROM & CO., INC.
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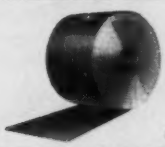
With operation based on a single prime-mover and torque converter, AC, DC and Diesel-Powered TorKars are establishing new standards of shuttle car performance, with sharply reduced maintenance.

Greensburg Locomotives

From National Mine's Greensburg Division, a complete range of Monitor Type Storage Battery and Diesel Locomotives from 2 to 15 tons. More pulling power per ton, higher efficiency for every invested dollar.

Wheat National Electric Cap Lamp

A major advance in better light for the miner, incorporating significant new developments in battery, bulb and fingertip focussing—resulting in better light, greater utility, better service.

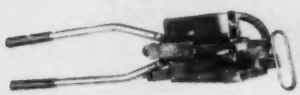


Scandura Belting

Stronger, lighter and more durable, fire-resistant P.V.C. Scandura is best for the long haul; best for extensibles! More productive because it stays on the job without expensive repair.

Clarkson Redbird Conveyor Chains

The leader in conveyor chain performance, with balanced construction providing longer, trouble-free service. Welded flight assembly lessens wear and strain, eliminates need for adjustment. A Clarkson Division product.



Hayden Belt Fastening Equipment

Using Tenex Hooks, the small, easily portable 17½-lb. Hayden "Autoclip" makes stronger conveyor belt splices in less time on the job and in limited working space. Material cost 25% lower, labor cost 75% lower—plus economies of reduced downtime.

Marietta Continuous Miner

This is a rugged, powerful, caterpillar-mounted, boring-type continuous mining machine of proven high capacity in coal and non-metallic mining—built by National Mine's Clarkson Division.

NATIONAL MINE SERVICE COMPANY

Koppers Building · Pittsburgh 19, Pa.

National Mine Service (Canada) Limited, Elliot Lake, Ontario

3 MANUFACTURING DIVISIONS

7 DISTRIBUTING DIVISIONS

For those hard, tough jobs . . . try

CHROME MOLY or MANGANESE STEEL CASTINGS

• Discharge grates in ore grinders have to be made of a metal that's tough, hard and strong. That's to withstand the abrasion and corrosion of ore, water and grinding media. Capitol Foundry Division casts discharge grates from CHROME MOLY or MANGANESE STEEL for the West's fast-expanding mining industry. Chrome moly or manganese steel castings can help cut *your* costs. Consider Capitol Foundry Division for service, delivery and quality. AA-8844

THEY'VE GOT TO BE TOUGH!

CAPITOL FOUNDRY DIVISION

NATIONAL MALLEABLE and STEEL CASTINGS COMPANY

Post Office Box 750, Phoenix, Arizona

GENERAL OFFICES - CLEVELAND 6, OHIO

Established 1868

Manganese Steel Castings • Carbon Steel Castings • Alloy Steel Castings
Ni-Hard Castings • Gray Iron Castings • White Iron Castings

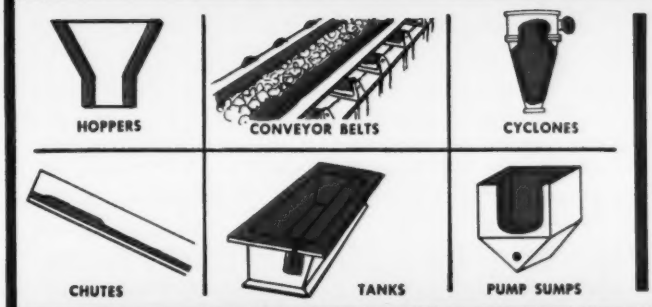
LINATEX®

LASTS LONGEST

CUT COSTS

NOW-LINATEX

DEFEATS ABRASION AND CORROSION IN MINING-EVERYWHERE!



TYPICAL DOLLAR-SAVING APPLICATIONS

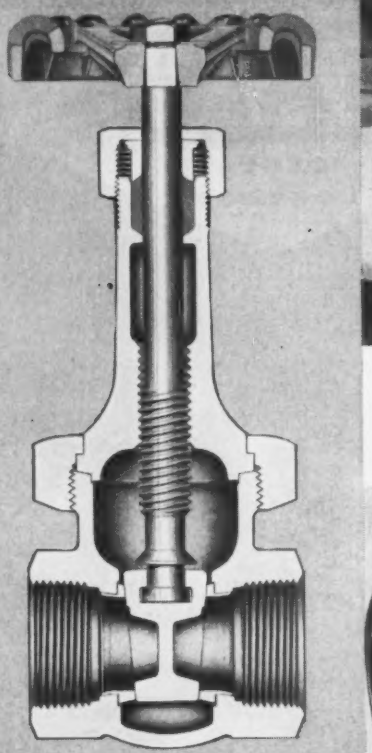
Complete information on Lining with LINATEX: Specific recommendations for your particular problems: representative in principal areas: or

Write for additional Information

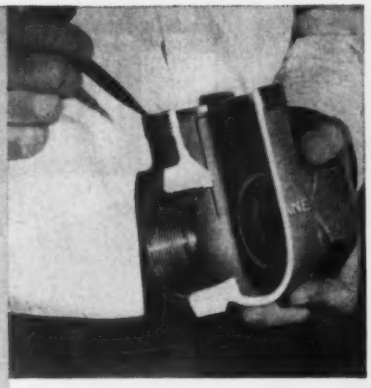
LINATEX

CORPORATION OF AMERICA

P.O. DRAWER "D" STAFFORD SPRINGS, CONN.

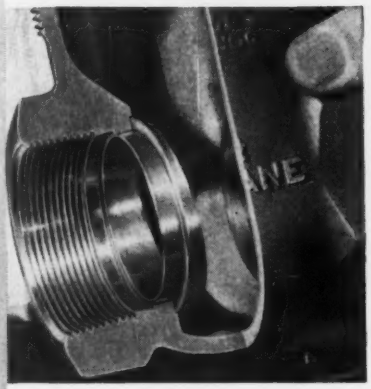


COMPLETELY NEW—loaded with improved service features inside and out. Two complete lines: rising stem pattern (No. 634E—cross section shown), non-rising stem (No. 636E)—both in sizes ¼ to 3 in. incl., with screwed ends. See below for literature.



NEW CYLINDRICAL BODY SHAPE—a proven design on high-pressure steel valves—increases strength without added bulk, distributes pressure load uniformly, resists distortion and leakage at seats.

NEW, STRONGER HEX ENDS, better integrated with body, eliminate sharp contours, give entire valve more rigidity under line strains. Wider hex faces allow firmer wrench grip for easier installation. Marring less likely.



NEW, EXPANDED-TYPE BODY RINGS insure long, tight-seating service life. They're rolled in, can't work loose. Shoulder at bottom of end threads restrains excessive entry of pipe against possible seat damage.

NEW EXELLOY, 12% chromium steel body rings give a hard bearing surface, highly resistant to wear, indentation, scoring and foreign matter damage. Easily replaced bronze disc takes the brunt of normal wear.

New design for tough service...easy maintenance

300-Pound Wedge Disc Bronze Gate Valves

Rising Stem and Non-Rising Stem Patterns

A new body shape that distributes greater strength uniformly against internal stresses and external strains . . . better integrated hex ends, huskier and wider, that add to body rigidity and give a firmer wrench grip . . . new rolled-in, high wear-resisting alloy body rings that don't work loose . . . easily renewed wedge disc—these are typical important features of new Crane bronze gate valves.

On your toughest services, these valves assure ultimate durability . . . new ease of application . . . low-cost repairability. And they're priced no higher than ordinary 300-pound integral seat bronze valves.

Easy to Repair—The Disc Takes the Wear

After long, hard service the hard Exelloy (12% chromium) body rings show no appreciable wear. Normal seating wear is taken by the bronze disc. When needed, a new disc, easily slipped onto stem, provides a practically new, tight-seating valve.

Circular Gives The Facts

For complete technical data on both rising stem and non-rising stem patterns . . . size listing, etc., get Circular AD-2340 from your Crane Representative, or by writing to address below.

CRANE® VALVES & FITTINGS

PIPE • PLUMBING • HEATING • AIR CONDITIONING

Since 1855—Crane Co., General Offices: Chicago 5, Ill.—Branches and Wholesalers Serving All Areas

New Conveyor System

. . . gives far greater belt life

. . . reduces maintenance

. . . and you get it *exclusively* from McNally Pittsburg

A completely new Cradle Idler* is the key to this high-efficiency McNally Pittsburg conveyor design. By mounting new 5" rubber rollers on a *nonrotating*, stainless steel rope, dangerous harmonics and "loping" are eliminated—permitting greater capacity and faster belt travel with minimum spillage. The *true catenary* of this suspension provides uniform belt support with no bends or creases—belt life is substantially increased.

Because of the unusual simplicity of this new McNally Pittsburg conveyor design, installation costs are lower—and maintenance costs are at a minimum.

*Patents Pending

New shock absorbing 5" rubber rollers have precision ground ball bearings, prelubricated and lifetime sealed.

With true catenary suspension, belts stay flat; support is uniform under all conditions for far longer belt life.

On-the-job construction is simple. The entire conveyor uses standardized components for easy assembly to fit your particular needs.

WRITE TODAY for details on this new McNally Pittsburg conveyor which costs less to install . . . saves money every day it is in use.

McNALLY PITTSBURG

McNally Pittsburg Manufacturing Corporation—
Manufacturing Plants: Pittsburg, Kansas • Wellston, Ohio
Engineering and Sales Offices: Chicago • Rio de Janeiro
Pittsburg, Kansas • Wellston, Ohio

McNally Pittsburg Mfg. Corp.
Dept. EMJ
Pittsburg, Kansas

☐ Please send information on the new McNally Pittsburg belt conveyor.

☐ Have Sales Engineer call for further consultation.

Name_____ Title_____

Company_____

City_____ State_____

Simplex PRODUCTS GUIDE

SIMPLEX WIRE & CABLE CO., CAMBRIDGE 39, MASSACHUSETTS, U.S.A.

ANHYDREX — Simplex ANHYDREX Insulation, with over thirty years of success behind it, is universally accepted as a truly "all-purpose" insulation.

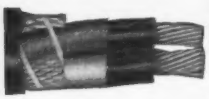
CATALOGUE #1028

ANHYDROPRENE — Simplex ANHYDROPRENE Cables are designed for economical installation in ducts, conduits, racks, trays and raceways. Stock sizes AWG 14 to 1000 MCM are recommended for 75 C service in wet or dry locations. Other ANHYDREX compounds are available for service to 5000 volts with conductor temperatures of 90 C in wet or dry locations.
(U.L. labels available as appropriate)

CATALOGUE #1028

ANHYDREX-NEOPRENE — Simplex ANHYDREX-NEOPRENE Cables have the added mechanical protection necessary for aerial and direct burial service. Stock sizes AWG 14 to 1000 MCM are recommended for 75 C service in wet or dry locations. Other ANHYDREX compounds are available for service to 5000 volts with conductor temperatures of 90 C in wet or dry locations.
(U.L. labels available as appropriate)

CATALOGUE #1028



ANHYDREX-PLASTEX — Simplex ANHYDREX-PLASTEX (ANHYDREX-insulated, PLASTEX-jacketed) Cables are scientifically designed for compatibility between insulation and jacket, and for perfectly balanced performance in ducts, conduits, aerial and direct burial installations. ANHYDREX-PLASTEX Cables are recommended for service in a number of environments but especially where oils and chemicals are a problem.

CATALOGUE #1028

ANHYDREX Insulated Control Cables — Simplex ANHYDREX Control, Signal and Communication Cables have an additional thickness of appropriately coded neoprene over each individual conductor, plus heavy-duty neoprene jackets. ANHYDREX insulation provides excellent signal reproduction and is exceptionally stable, even when operating with high ambient temperatures.

CATALOGUE #1028

ANHYDREX XX — Simplex ANHYDREX XX is a butyl-based insulation of the highest possible quality. Because of its exceptional resistance to heat and ozone, it has general applications in circuits operating up to 35,000 volts, with permissible conductor temperatures of 90 C. to 5KV, and 85 C to 17KV — in wet or dry locations.

CATALOGUE #1023

CONDEX — Simplex CONDEX Cables are protected against mechanical damage by interlocked metallic armor. The armor is manufactured of galvanized steel, plain or baked enameled (colored) aluminum, bronze or other metals, and can be applied over any cable core within a very wide diameter range. CONDEX Cables may be further protected by a thermoplastic covering over or under the metallic armor.

CATALOGUE #1024

TIREX SO and SJO Cords — TIREX SO and SJO Cords are constructed to meet the most rigid specifications. All of their special features are carefully selected and processed to give maximum qualifications for portable service. They will twist without kinking, and bend without breaking. TIREX stranding affords maximum flexibility without sacrificing strength.

Conductor temperature rating 75c

CATALOGUE #992

TIREX Low Voltage Portable Cables — TIREX Low Voltage Cables are individually designed for specific applications. They are practically indestructible when used to do the work for which they are intended.

Conductor temperature rating 75c

CATALOGUES #992 & #1011

TIREX High Voltage Portable Cables — TIREX High Voltage Portable Cables have unequaled strength and versatility. Designed primarily to transmit energy to mobile electrical equipment, they are also used as temporary power lines during alterations or emergency repairs.

Conductor temperature rating 75c

CATALOGUE #1012

TIREX Mine Locomotive Cables — TIREX Mine Locomotive Cables — both single and two-conductor concentric — are approved by the Bureau of Mines and have the raised marking "P-101 BM" on their heavy-duty neoprene jackets. All TIREX Cables are cured and conditioned for service in lead.

Conductor temperature rating 75c

CATALOGUE #1011

TIREX Mining Machine and Shuttle Car Cables — TIREX Mining Machine and Shuttle Car Cables are designed for stability under today's rigorous mining conditions. The insulated conductors are "ribbed" or gear-shaped. This feature causes them to interlock with the heavy duty neoprene jacket and prevents them from slipping. Both Type W and Type G have "P-101 BM" molded onto the jacket.

Conductor temperature rating 75c

CATALOGUE #1011

TIREX Dredge and Shovel Cables — TIREX Dredge and Shovel Cables are masterpieces of engineering achievement. Every consideration has been given to safety and durability. Simplex special cured-in-lead neoprene armor effectively resists all the elements normally encountered in this type of work.

Conductor temperature rating 75c

CATALOGUE #1012

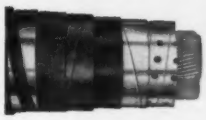
TIREX Welding Cables —TIREX Welding Cables are scientifically stranded for maximum flexibility without wrist drag. Cured-in-lead neoprene jackets provide utmost safety for both operator and bystanders.

Conductor temperature rating 75c

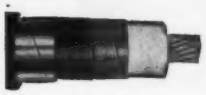
CATALOGUE #1011

AND CATALOG REFERENCE

Please address requests to the Simplex home office in Cambridge or to your nearest Simplex district office.



Simplex Paper Insulated Cables — Simplex Paper Insulated Cables are individually designed for specific jobs. They are available as either single or multiple conductor cables. The stranding may be round, segmental, sector or compact. Lead sheaths, reinforced neoprene jackets, or combinations of these are available for protection against moisture.

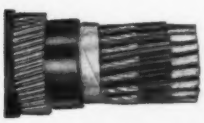


Simplex Polyethylene Insulated Cables — The versatility of Simplex Polyethylene has increased tremendously during the last ten years. Research has adapted it, not only to control and communication circuits, but also for power applications up to 35,000 volts. Our experience in this specialized field is unmatched by any other cable manufacturer.

Simplex SIMCONEX Insulation — SIMCONEX (Simplex silicone) Insulated Cables are specially designed for service where unusually high operating temperatures prevail. SIMCONEX may be specified on all types of power, control, and communication cables. It is practically immune to ozone and corona and, with its minimum temperature rating of 125 C, it has the greatest resistance to heat of any known thermosetting insulation.

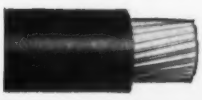
CATALOGUE #1032

Diesel Locomotive Cables — Diesel Locomotive Cables are specially insulated and jacketed for 90 C service in the following applications: generator leads, motor leads, power jumpers, control jumpers, lighting systems, headlight wire, controller wiring, and cab signal wire. Highly flexible stranding promotes easy installation.



Antimicrophonic Cables — Simplex Antimicrophonic Cables are adaptable wherever extremely fine measurements are to be made. They will not produce spurious voltages when compressed, deformed or subjected to violent shock. Can be manufactured with a varying number of conductors and conductor sizes.

Bore Hole and Shaft Cables — Bore Hole and Shaft Cables are generally insulated with Simplex ANHYDREX moisture-resistant insulation. Mechanical protection is provided by galvanized or stainless steel, copper, copperweld or other appropriate round wire armor. PLASTEX jackets may be specified over or under the wire armor.



PLASTEX Apparatus Wire — Simplex PLASTEX Apparatus Wire — for machine tool, switchboard wiring and other similar applications. Simplex PLASTEX is available to meet a wide range of operating temperatures.

C-L-X Sheaths — Simplex C-L-X is a continuously corrugated, pliable, lightweight, exterior metallic cable sheath which is impervious to gases, chemicals, and water. Its unique construction makes it adaptable to nearly all environments or services and gives it a combination of properties unmatched by any cable system now manufactured. C-L-X is appropriately called "the metallic duct with built-in cable."

CATALOGUE #1031

ANHYDREX Submarine Cables — Simplex ANHYDREX Submarine Cables for power, control and communication circuits are designed from experience dating back to 1920. (The moisture resistance of ANHYDREX made possible the first nonleaded submarine cables.) High tensile strength armor wires of steel or other appropriate metals provide the best possible mechanical protection.

Self-Supporting Aerial Cables — Simplex Self-Supporting Aerial Cables for power, control and communication circuits practically eliminate the necessity of tree trimming. They are completely assembled at the factory and ready for installation. Because of this, they are extremely easy to handle and cut installation cost to a fraction of what it would normally be.

CATALOGUE #1006

Lead Covered Cables — When a customer's specifications demand a lead sheath, Simplex has full facilities for its manufacture. A number of high-grade lead alloys are available including tellurium, copper bearing and arsenical. Recent studies enable Simplex engineers to recommend the most appropriate lead sheath alloy for your particular application.

Railroad Signal and Communication Cables — Railroad Signal and Communication Cables may be insulated with either ANHYDREX or Polyethylene, with mechanical protection, according to individual needs. Bronze tapes are usually provided in direct burial constructions.

Cathodic Protection Cables — Cathodic Protection Cables are used to equalize voltage potential between metallic structures and the earth. Simplex ANHYDREX or Polyethylene insulations may be specified with complete confidence.

CATALOGUE #1033

Simplex Varnished Cambric Cables — Simplex Varnished Cambric Cables are particularly suited for station or power house wiring, or for any service where the operating temperature is high. Between each layer of varnished cambric is a plastic filler compound which is nonhardening, and nonmigrating. It allows the tapes to slip one upon the other without danger of wrinkling.

BULLETIN #108

Wear-O-Matic Hard Surfacing is 3 Ways Better

1 *Faster . . . More Economical*

The Wear-O-Matic process of semi-automatic hard surfacing is continuous welding with manual control of the arc. However, unlike manual welding with stick electrodes, there is no time consuming slag cleaning or electrode changes. Higher deposition rates, 3 to 5 times faster than stick electrodes, greater deposition efficiency, 85 to 95%, plus more available arc time add up to savings of 40 to 50% over manual hard surfacing with stick electrodes.

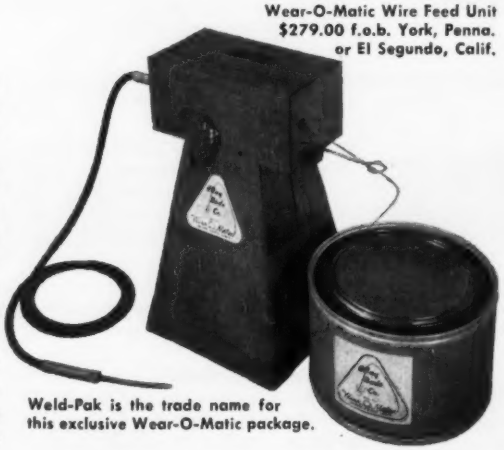
2 *Uniform Resistance to Wear*

The superior wear resistance qualities of Wear-O-Matic hard surfacing wires is the result of closely controlled manufacture, properly balanced alloys and fluxing agents, and precision drawing. Wear-O-Matic 7/64″ diameter open arc wires are precision drawn to true wire diameter ± 0.002″ and through drawing are densely compacted assuring an easier feeding wire that will not crush in the feed rolls or bind in the feed cable. Dense compaction and closely controlled fabrication combine to provide a weld deposit more uniform in chemistry and metallurgy resulting in uniform hardness and greater wear resistance throughout the deposit.

3 *Greater Efficiency and Ease of Application*

Here's a hard surfacing combination *designed* to cut maintenance cost through the *profitable* utilization of your welder's time. Wear-O-Matic wires in WELD-PAKS are the key to greater efficiency of both semi-automatic equipment and operator. Each WELD-PAK contains 100 pounds of wire packaged in a "dead cast" resulting in tension free, snarl free feeding. Because the WELD-PAK contains 2 to 4 times more wire than standard coils, the amount of time spent handling wire is lessened, providing more time for welding. WELD-PAKS are easier to handle and store; and on the job, the lid can be replaced after use assuring dirt and dust free wire when you are ready to resume welding. From set-up to finished job, the Wear-O-Matic process is easier and faster, eliminating overtime or providing more time for other maintenance jobs. Job test this time saving process in your own shop. Request Bulletin HS-149 for complete details. Alloy Rods Company, P. O. Box 1828, York, Pennsylvania.

Wear-O-Matic Wire Feed Unit
$279.00 f.o.b. York, Penna.
or El Segundo, Calif.



Weld-Pak is the trade name for this exclusive Wear-O-Matic package.

Alloy Rods Company

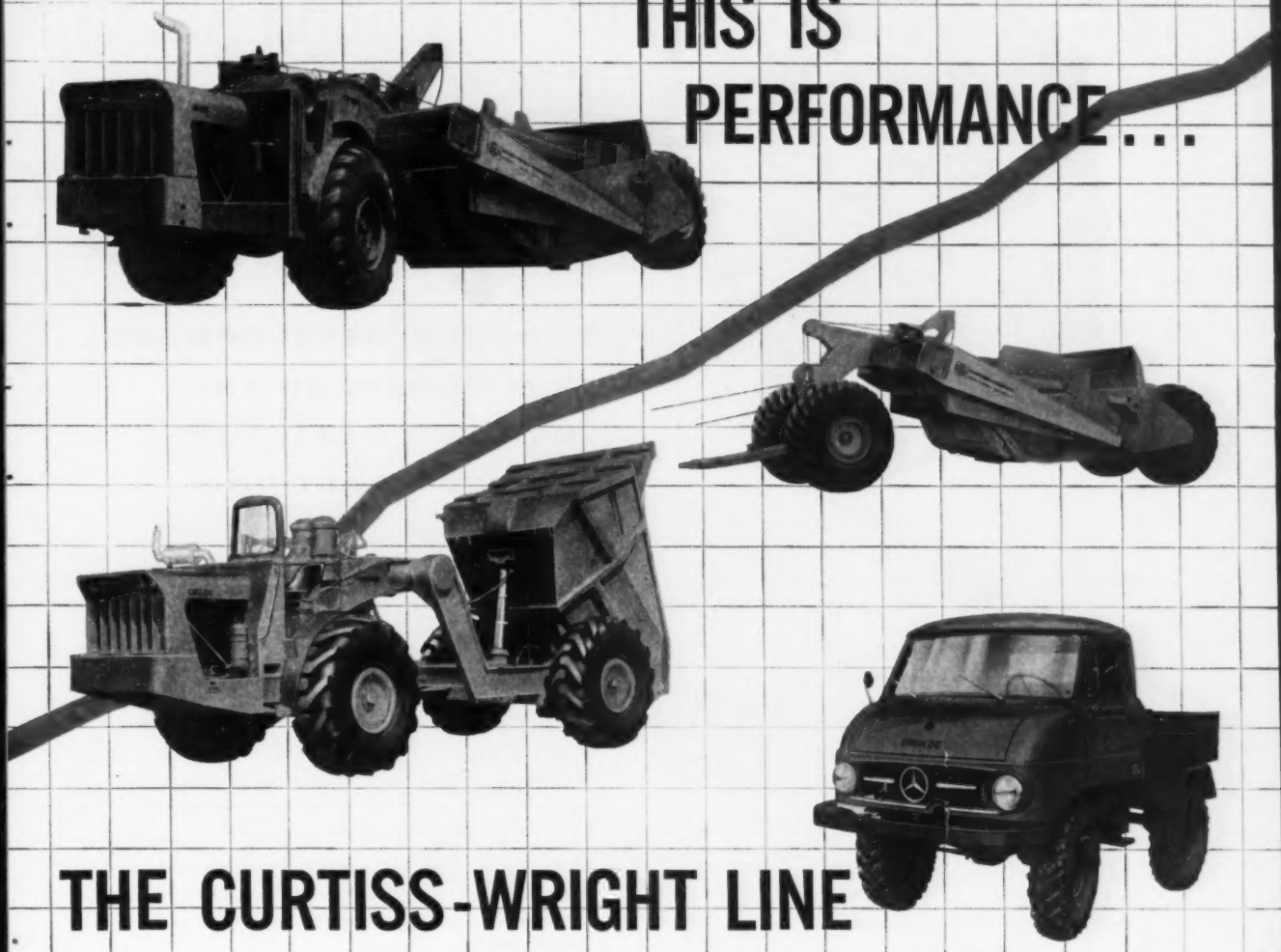
YORK, PENNSYLVANIA • EL SEGUNDO, CALIFORNIA

QUALITY WELDING ELECTRODES FOR

- Stainless Steel
- Low Alloy Steels
- Cast Iron
- Tool Steel
- Bronzes & Dissimilar Metals
- Hard Surfacing Electrodes & Wires

NO FINER ELECTRODES MADE . . . ANYWHERE

THIS IS PERFORMANCE...



THE CURTISS-WRIGHT LINE

SELF-PROPELLED SCRAPERS:

Five high-speed, high capacity machines in models from 7 cu. yds. to 26 cu. yds. struck capacity.

PULL-TYPE SCRAPERS:

A complete line of six heavy-duty units in models from 8 cu. yds. to 30 cu. yds. struck capacity.

REAR DUMPERS:

Three rugged rear dump units interchangeable with four scraper bodies. 25 to 35 ton capacities. 14 cu. yds. to 21 cu. yds. struck capacity.

MERCEDES-BENZ UNIMOG:®

The UNIMOG, with Mercedes-Benz diesel engine, 4-wheel differential lock, 4 power take-offs and hundreds of attachments handles an infinite variety of off-the-road applications.

® UNIMOG and MERCEDES-BENZ are registered trade marks of DAIMLER-BENZ A.G., Stuttgart, Germany.

Performance on the job — the ability to move materials swiftly and economically under the widest variety of working conditions — is characteristic of Curtiss-Wright equipment. Engineering and production experience, centralized at the modern South Bend plant of Curtiss-Wright Corporation, results in machines that exceed operator's own performance requirements in both production and profits.

The world famous UNIMOG, a multi-purpose machine of unequalled versatility, is exclusively distributed in North America by Curtiss-Wright . . . This Mercedes-Benz vehicle, a product of Daimler-Benz, AG, delivers exceptional performance under the most difficult off-the-road conditions.

See your Curtiss-Wright Construction Machinery distributor for a demonstration and information.

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CURTISS-WRIGHT

CORPORATION

SOUTH BEND, INDIANA

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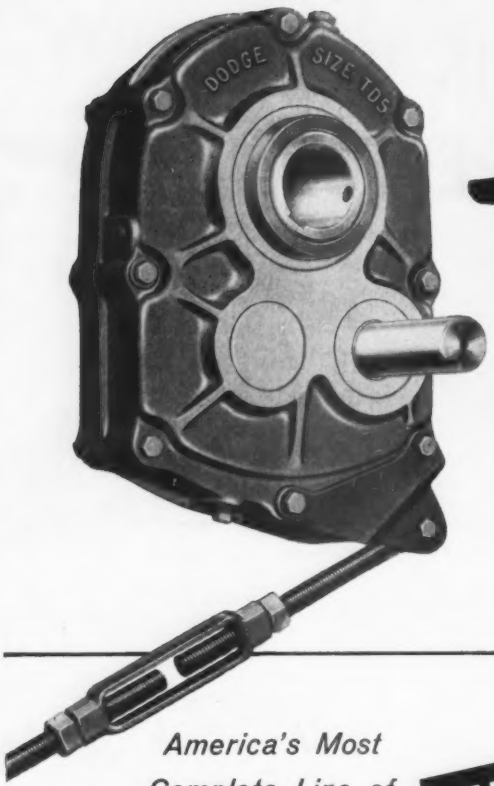


Torque-Arm

THE DODGE DEVELOPMENT THAT CHANGED THE NATION'S HABITS OF SPEED REDUCTION

America's Most Complete Line of Shaft Mounted Speed Reducers

55 MODELS

- 1 to 200 hp. at 100 rpm!
- Output speeds from 10 to 378 rpm!
- Single Reduction
- Double Reduction
- 5 to 1 Ratio
- 15 to 1 Ratio
- 25 to 1 Ratio
- Any speed ratio up to 150 to 1 obtainable by selection of pre-determined combination of reducer and V-belt drive.

CALL THE TRANSMISSIONEER—your local Dodge Distributor. Factory trained by Dodge, he can give you valuable help on new, cost-saving methods. Look in the *white* pages of your telephone directory for "Dodge Transmissioneer."

In fewer than ten years, the range of Torque-Arm Shaft Mounted Speed Reducers has increased from 6 to 55 models, to meet the ever increasing demand for this improved method of speed reduction.

By eliminating foundation, sliding base and flexible coupling this modern speed reducer has saved untold installation time and untold dollars of cost.

The rugged semisteel housing developed by Dodge has never been improved upon. It is corrosion resistant—and it has the strength to hold bearing seats in line for the life of the unit.

Dodge design provides wide spacing for the bearings. Loads are carried easily, contributing to Torque-Arm's long life and very high efficiency. The gears are finest quality—helical, heat treated steel.

Torque-Arm mounts vertically or horizontally in any position around the driven shaft. It locks to the shaft on *both* sides of the housing. The holes in the output hub provide simple removal with puller. Overload release and built-in backstop are optional.

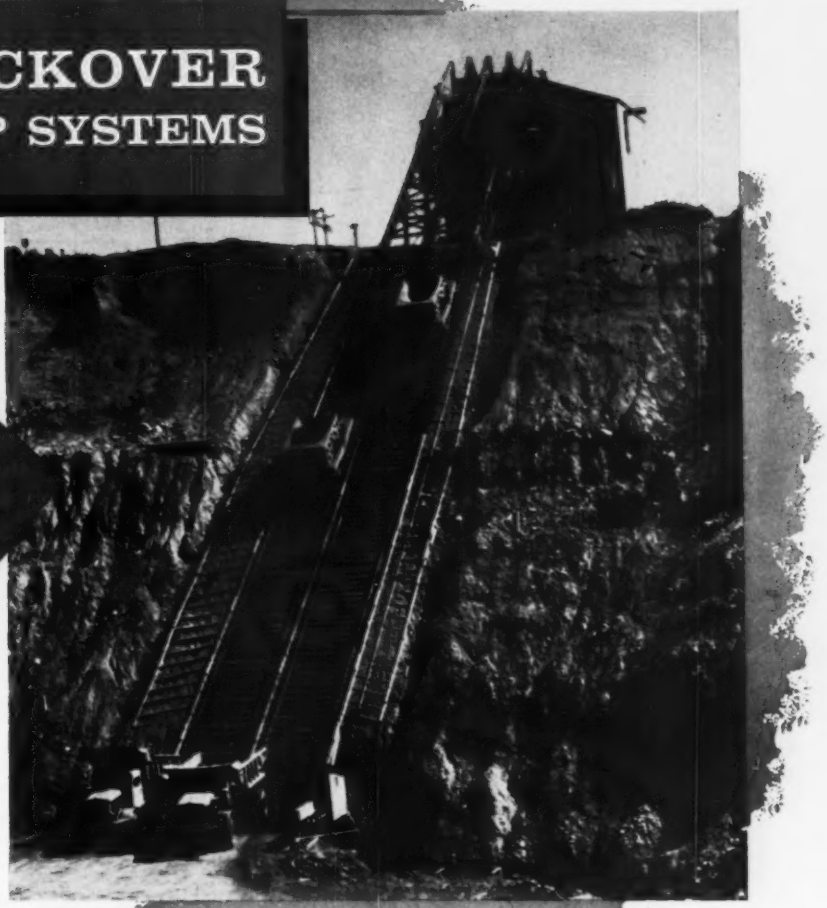
Dodge Torque-Arm is America's most widely used shaft mounted speed reducer. It is stocked by your local Dodge Distributor. Ask him. Or write us for bulletin.

DODGE MANUFACTURING CORPORATION, 3100 Union, Mishawaka, Ind.

DODGE
of Mishawaka, Ind.

Elevate materials at LOWEST COST PER TON

with ROCKOVER SKIP SYSTEMS



IN USE SINCE 1949

The ROCKOVER SKIP SYSTEM has proven to be the most economical method to elevate materials from open pits. It uses the shortest and fastest hauling route, has the lowest operating and maintenance costs and requires no large investment in parts and standby equipment.

Rockover Skip Systems require no expensive wide roads for pit access and require a minimum of personnel . . . are flexible to follow pit bottom as operations go deeper . . . haul either waste or ore at anytime . . . may be loaded at any desired bench and require no sizing equipment in the pit.

NICO SKIPS FROM 15 TO 50 TON CAPACITIES AVAILABLE

Write for illustrated brochure.

NATIONAL IRON COMPANY

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Subsidiary of Pettibone Mulliken Corp., Chicago 51, Illinois

BOTH REDUCERS HAVE THE SAME CAPACITY!

This dramatic saving in weight and space is possible only because the reducer on the left has Philadelphia Precision Ground Gearing . . . a new development, so significant you can solve drive problems you could never solve before . . . because you get engineering advantages that have never been available before.

For the first time, standard commercial speed reducers are available with gearing of master gear quality. Extreme accuracy of profiles, profile spacing and surface finish reduce dynamic load factors. Harder gear materials can be used. Result: increased load carrying capacity without sacrificing performance characteristics.

Gear noise is reduced to the point where it is no longer a controlling factor in applications where low sound levels are important.

Backlash is reduced in reversing drives . . . and it is uniform where precision of movement is important.

Vibration is virtually eliminated because tooth to tooth errors, accumulated pitch errors and composite errors are reduced . . . smoother contact results.

Longer gear life. Improved accuracy and better surface finish eliminates "running-in" periods and the resulting wear on gearing.

If you have a new product on the boards . . . design changes coming up . . . or new drive requirements of any kind, Philadelphia Precision Gear Drives may give you the competitive edge you've been looking for. Write for full data on precision ground gearing in spiral bevel, parallel shaft and In-Line reducers as well as gearmotors and Motoreducers. If you have a special drive problem, the full facilities of our engineering staff are available to help you find the solution.

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Offices in all Principal Cities • Virginia Gear & Machine Corp., Lynchburg, Va.
INDUSTRIAL GEARS & SPEED REDUCERS • LIMITORQUE VALVE CONTROLS • FLUID MIXERS • FLEXIBLE COUPLINGS

This Cast Tooth Really Slices Deep

25% faster...10 times longer!

It's cast of Wearpact Steel . . . engineered right

. . . and 500 Brinell hard from end to end.

When all the shouting about ripper tooth design is over, there are only two real considerations: How *well* does it cut, and how *long?*

On job after job, this WEARPACT tooth cut faster—and maintained that fast-cutting edge longer than any other known alloy!

Note the long, lean contours. Here's a tooth that slices cleanly. No need to "beef it up" to the point of dullness. Wearpact, with its unique combination of strength and resistance to impact and abrasion, actually does *more* work using *less* metal.

Ripper teeth are only one of many applications where tough Wearpact Steel saves money. End bits, grousers, dipper teeth . . . all represent dollar-saving uses for this tough alloy, which has a 500 Brinell hardness range.

Write today—for information about demonstrating Wearpact on *your* tough jobs!

Look to

WEARPACT

CAST STEEL

to cut your digging costs!

In Canada: International Equipment Company, Ltd., Montreal 1, Quebec

AMERICAN STEEL FOUNDRIES
3700 Canal St., East Chicago, Ind.

☐ We are interested in testing Wearpact on_____
☐ Please send complete information on physical properties.

Name_____ Title_____

Company_____

Address_____

City & Zone_____ State_____

. . . in dry dust control

proved DUCLONE® features assure

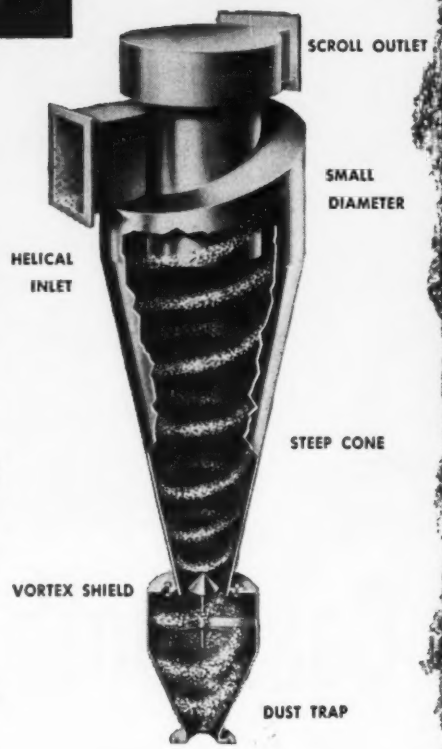
- ***HIGHER** efficiency*
- ***LONGER** service life*
- ***LOWER** operating cost*

Duclones—Ducon high efficiency cyclones—are designed and constructed for high efficiency and low gas resistance so that maximum recovery of industrial dusts is obtained at the lowest possible cost. Their sturdy construction assures long, continuous service with a minimum of maintenance.

The exceptional performance of Duclone collectors is the result of these 6 unique features:

1. Small Diameter produces high efficiency
2. Helical Roof provides a turbulence-free path for the entering gas stream
3. Steep Cone improves dust separation
4. Dust Trap assures efficient dust removal from the cone
5. Vortex Shield prevents re-entrainment of dust in upward gas vortex
6. Scroll Outlet provides a low resistance clean gas outlet

Duclones are available in single and multiple units and in special materials of construction.



For complete information send for Bulletin C-958.

DUCON — DUST CONTROL SYSTEMS AND EQUIPMENT

the name in DUst CONtrol

THE Ducon COMPANY INC.
147 EAST SECOND STREET • MINEOLA, L. I., NEW YORK

Canadian Branch:
THE DUCON COMPANY of CANADA, Ltd.,
1131 Pettit St., BURLINGTON, ONTARIO

CYCLONES • CENTRIFUGAL WASH COLLECTORS • TUBULAR CLOTH FILTERS • DUST VALVES

to cut your digging costs!

In Canada: International Equipment Company, Ltd., Montreal 1, Quebec

City & Zone _____ State _____

VERSATILE!

1 Mobile Drill does all 4

- SOIL SAMPLING
- DIAMOND DRILLING
- AUGER BORING
- PERCUSSION DRILLING

the powerful, field-proven

B-52 PACEMAKER

HYDRAULIC ROTARY DRILL

features

time-saving HOLLOW STEM AUGER... lets you sample while you bore!

ONLY 4-IN-1 RIG ON THE MARKET

Mobile Drill's new B-52 PACEMAKER brings you unequalled versatility to meet today's demand for greater drilling speed and flexibility. Here's a rugged, powerful, heavy-duty workhorse that mounts on 1½ to 2½ ton vehicles and will drive 5′ sectional augers to 200′ . . . diamond core drill to 1000′.

BIG POWER . . . BIG PERFORMANCE

PACEMAKER's twin hydraulic feed develops 10,000 lbs. hydraulic ram force! Rig has own independent power plant, variable speed control on rotary drive.

COMPACT . . . SELF CONTAINED

Custom mountings are designed to meet your needs. Special body fabrications provide storage racks for augers and watertight compartments for tools and accessories . . . everything to make the PACEMAKER a mobile, fast moving, time saving unit.

TIME-SAVER No. 1

22′ TOWER—Permits withdrawal of tools in 20′ lengths. Mechanically operated, jack-knifes to horizontal position for safe, legal highway travel.

TIME-SAVER No. 2

OFF-THE-HOLE HYDRAULIC BASE—Rail-mounted base slides out of way while adding or withdrawing drill sections, assures continuous perfect alignment. Hydraulically operated.

TIME-SAVER No. 3

CENTRALIZED 1-MAN CONTROL GROUPING—Located on operator's side of drill base, within easy reach. Fingertip controls plus advanced safety design increases operator's efficiency.

TIME-SAVER No. 4

HOLLOW STEM AUGERS—Actually permit all types of sampling while you bore! Augers form their own casing, also allow coring through hollow stem after rock has been reached.

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WRITE FOR BULLETIN TODAY!

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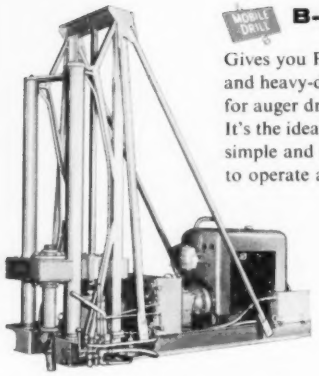
Get **MODERN MOBILITY** with **MOBILE DRILLS** . . famous the world over for operating ease, speed, economy

MOBILE DRILL

modern mobility

gives you the speed, power, versatility to handle any drilling job . . . **anywhere!**



B-52

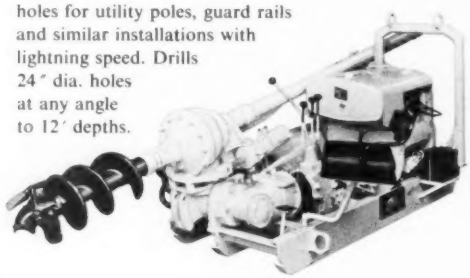
Gives you Pacemaker power and heavy-duty performance for auger drilling to 200′. It's the ideal starter rig . . . simple and economical to operate and maintain.

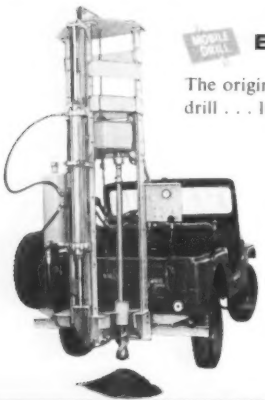
B-40 EXPLORER

International award winning B-40 brings you unequaled versatility in drilling. This light weight unit augers to 100′ and core drills to 250′ . . . it's a natural for diversified exploratory work.

DIGGER

A production unit built to bore holes for utility poles, guard rails and similar installations with lightning speed. Drills 24″ dia. holes at any angle to 12′ depths.





B-27

The original Jeep mounted auger drill . . . lightweight, fast and easy to operate. Hip-pocket B-27 is ideal for exploratory auger drilling to 75′. You can't beat it for maximum profitable return on a minimum investment.

B-36

Medium weight husky that drives 6″ augers to 100′ through difficult formations. Rugged, dependable and safe for economical drilling under varied conditions.

● **Tools and Accessories to meet your every drilling requirement are illustrated in Mobile Drills complete new Accessory Catalog. Write for free copy today.**

MOBILE DRILLING, INC. • 960 N. Pennsylvania St., Dept. 50, Indianapolis 4, Ind.

Always DEPENDABLE For Moving Water and Tailings

NAYLOR Spiralweld pipe is light in weight, but has what it takes to handle piping jobs in mining operations.

It's easy to handle and install even over rough terrain. The spiral-lockseam provides the strength and safety required for rugged service—whether operations call for moving water and tailings, hydraulicking or handling air under pressure or ventilating.

You save time and work, too, when you use the one-piece NAYLOR Wedgelock coupling to make connections.

For full details, write for Bulletin No. 59.

NAYLOR PIPE *Company*

1243 East 92nd Street, Chicago 19, Illinois

Eastern U. S. and Foreign Sales Office: 60 East 42nd Street, New York 17, N. Y.

FIELD REPORTS PROVE SUPERIOR PERFORMANCE OF NEW BOSTON BELTS

DIGEST OF PERFORMANCE FIGURES FOR 1296 BELTS*

44% increase in consistency of tensile strength

6% increase in tensile strength

130% improvement in consistency of elongation

* Compared to belts previously manufactured

HERE'S WHAT DOES IT!

The startling figures above are a direct result of two major belt manufacturing advancements — both developed by, and exclusive with, Boston Woven Hose & Rubber Co.

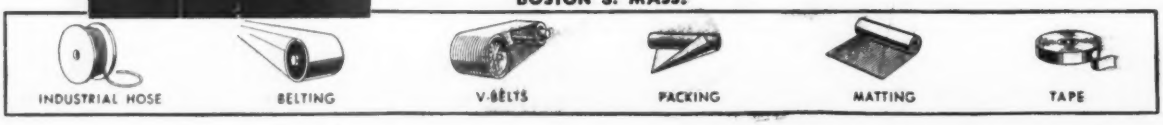
ADVANCEMENT #1 **BALANCED BELT CONSTRUCTION** for the first time equalizes ply stress so that each ply pulls its full share of the load. **BBC** eliminates lazy plies. A BOSTON exclusive because only BOSTON can combine Electronic Tension Controls with Rotocure, the continuous method of vulcanization, which assures uniformity throughout the belt.

ADVANCEMENT #2 **DULON** markedly improves the aging characteristics of BOSTON belts. An exclusive BOSTON research development, the tough specially treated cover compound stays resilient longer . . . makes the belt much more resistant to abrasion, gouging, tearing and oxidation.

BALANCED BELT CONSTRUCTION plus **DULON** add up to longer belt life . . . less trouble in service . . . greater economy.

BOSTON

BOSTON WOVEN HOSE & RUBBER COMPANY
DIV. OF AMERICAN BILTRITE RUBBER CO., INC.
BOSTON 3, MASS.



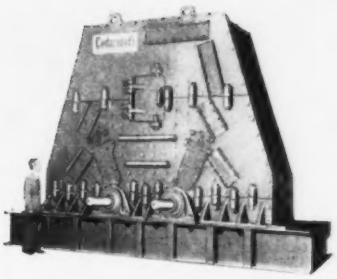
Want lowest cost per ton? . . . buy

Cedarapids

Built by IOWA

Heavy-Duty Equipment for Reducing Processing Costs

When the equipment you use in processing ore bears the Cedarapids Trademark, you can be *sure* of design, engineering, and quality construction that consistently gives the lowest possible cost per ton in crushing, screening and handling operations. With Cedarapids equipment you get *extra strength* built in for heavy-duty service . . . heat treated crusher bases and screen boxes, rigid rib reinforcement, larger than average eccentric shaft, etc. Each Cedarapids unit is skillfully engineered for *extra hourly tonnages*... among the many capacity-increasing features are overhead eccentric forced feed jaw crusher design, heavier-than-average flywheels, more efficient feeding methods, horizontal screen design. And "service-proved" low maintenance is another Cedarapids benefit that helps you get lowest cost per ton. It will pay you to investigate Cedarapids advantages thoroughly. Write for literature.



DOUBLE IMPELLER IMPACT BREAKERS

In increasing use for crushing a wide variety of minerals from calcite to zinc ore. Exceptionally high capacity, plus high reduction ratios which often eliminate the need for other secondary crushers, makes these Impact Breakers profitable for your mining operations. Six models, from 22″ x 22″ to 53″ x 60″.

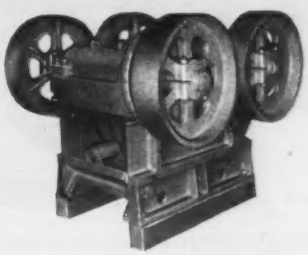
IOWA MANUFACTURING COMPANY

Cedar Rapids, Iowa, U.S.A.

SEE YOUR NEAREST CEDARAPIDS DISTRIBUTOR FOR FULL DETAILS

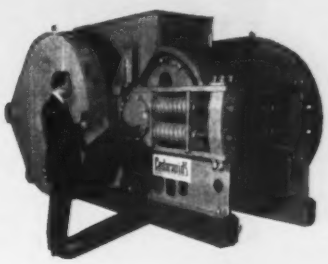
SINGLE-JAW CRUSHERS

Proper eccentric throw, angle of toggle and proper RPM are balanced for extra crushing capacity. Single-Jaw Crushers available in a wide range of sizes from 42″ x 48″ to 10″ x 16″.



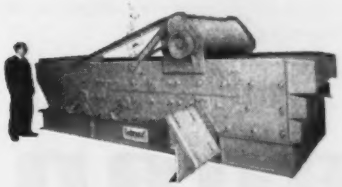
TWIN-JAW CRUSHERS

A Cedarapids exclusive design! Two movable synchronized jaws, operating at high speed, give you 40% to 100% higher primary crushing capacity than single-jaw crushers of the same size.



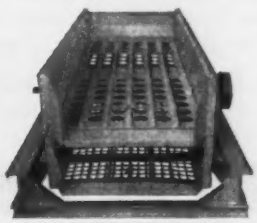
ROLL CRUSHERS

Where high capacities of fine crushed products are required, Cedarapids Roll Crushers are ideal units for secondary reduction. 8 sizes available with several types of roll shells.



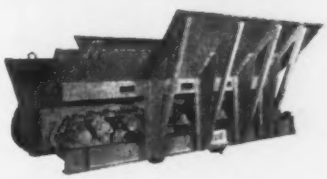
HORIZONTAL VIBRATING SCREENS

Horizontal screen cloth openings permit more of the correct size material to go through, yielding 30% more capacity than inclined screens of the same size. Sizes: 3′ x 8′ to 60″ x 16′, double and triple deck.



HEAVY-DUTY SCALPING SCREENS

Inclined double-deck vibrating screens are sturdily built to handle 2′ to 3′ material. Eccentric shaft vibrating mechanism provides positive circle throw that assures fast, clean separation in one pass.

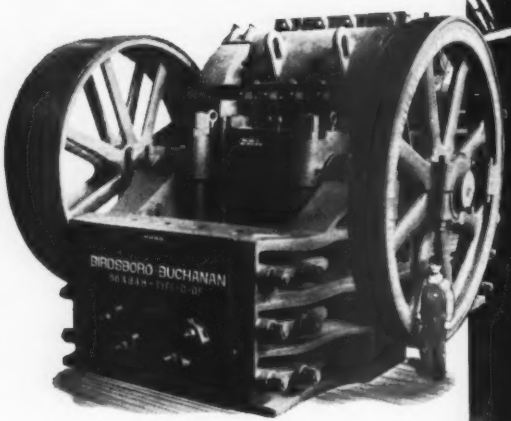


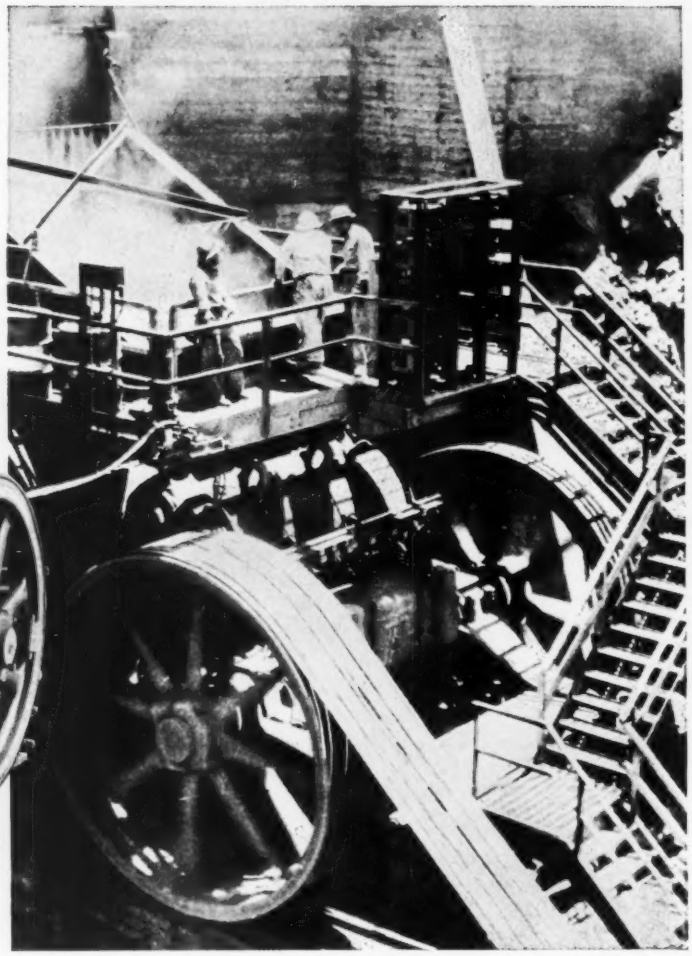
HEAVY-DUTY APRON FEEDERS

Especially designed for smooth feeding of heavy, large-sized material. Rugged construction, with 9 shafts beneath the heavy cast flights, withstands shock of dumping heavy material into feeder.

BIRDSBORO-Buchanan

Giant Crusher Chews Up Ore at Top Rate of 1000 Tons Per Hour . . .





● This Birdsboro customer turned a barren wasteland in Peru into a mushrooming iron mine in just four months. The ore from the approximate 70-million ton deposit is being broken in this mammoth 66x84-in. Birdsboro-Buchanan Deep Frame jaw crusher. One of the largest ever built, the crusher incorporates special Birdsboro-Buchanan design features. This ruggedly built machine's great depth and exceptional length of crushing surfaces provides fast, high production with minimum maintenance. Ask your Birdsboro representative to explain the exclusive Birdsboro-Buchanan features that make this possible. *Sales Department, Engineering Department and Plant:* Birdsboro, Pa., *District Office:* Pittsburgh, Pa.

Canadian Representative & Manufacturer: John Inglis Co., Ltd., Toronto, Canada. *World-Wide Agent Representation.* Contact home office for nearest representative.

CH-11-56R

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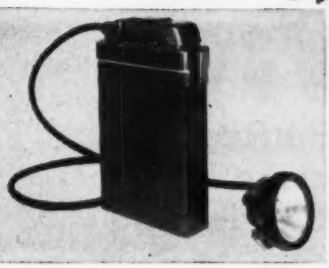
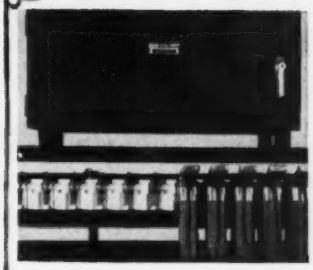
STEEL FOUNDRY AND MACHINE CO.

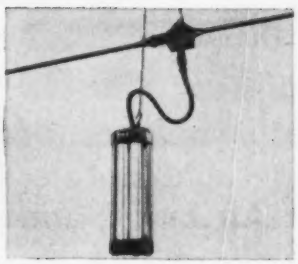
STEEL MILL MACHINERY • HYDRAULIC PRESSES • CRUSHING MACHINERY • SPECIAL MACHINERY • STEEL CASTINGS • Weldments "CAST-WELD" Design • ROLLS: Steel, Alloy Iron, Alloy Steel



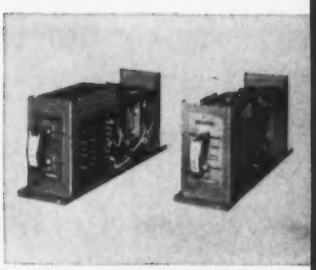
☐ **NEW EDISON MODEL 5 ELECTRIC CAP LAMP** provides greater safety for the miner, higher production for the operator. 15% increase in illumination. Smaller, lighter-weight headpiece. Improved battery.



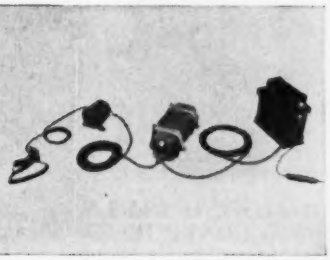
☐ **M-S-A® AUTOMATIC LOW-VOLTAGE CHARGING SYSTEM** is designed for the most economical method of lamp charging. Miners can put their lamps on charge with one motion and keep moving without any delay.



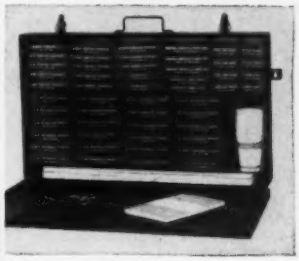
☐ **M-S-A® PERMISSIBLE MINE LIGHTING SYSTEM** cuts down accidents. Increases production. Provides dependable lighting with an instant start circuit. Available for either 110 or 220 volt AC circuits.



☐ **M-S-A® TRANSISTORIZED AUDIO TONE TRANSMISSION EQUIPMENT** permits economical centralized control and indication of fans, substations, motors, pumps, conveyor belts, switches, circuit breakers, and lights.



☐ **M-S-A® MODEL E-60 MINE-PHONE** is completely transistorized transmitter-receiver unit. Permits adaptation of every communication station in a mine to continuous operation in event of power failure.



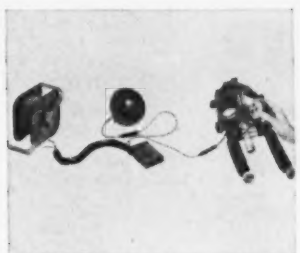
☐ **M-S-A® MINER'S FIRST AID CABINET** provides medical dressings and equipment for mine hospital or dressing station. Each unit package individually wrapped in cellophane. When open, lid serves as a work shelf.

☐ **M-S-A® ALL-SERVICE® MASK** with new Window-Cator canister, external check valve and M-S-A Clear-tone Speaking Diaphragm gives dependable breathing protection against smoke, toxic gases and fumes.

☐ **M-S-A® CHEMOX® BREATHING APPARATUS** completely safeguards breathing while travelling through any gaseous or oxygen deficient area. Generates its own oxygen supply from replaceable canister.

☐ **M-S-A® SELF-RESCUER®** gives immediate breathing protection in emergencies caused by fire or explosion. Compact. Lightweight. Can be stored without deterioration. Available in storage cases or individual carrying cases.

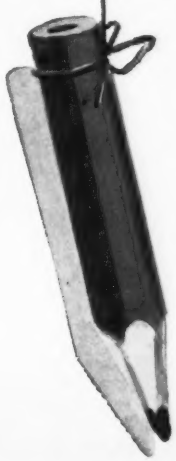
☐ **M-S-A® DUSTFOE RESPIRATOR** is light and compact for dependable protection against dusts, vapors, and mists. Allows maximum vision by the wearer. It's easy to clean. Design is modern and functional.



☐ **M-S-A® MINE RESCUE COMMUNICATION SYSTEM** with speaking diaphragm face piece sets up positive "party line" communication between rescue team and fresh air base. Transistorized. Battery-powered.

☐ **M-S-A® TYPE K SKULLGARD® HAT WITH NEW FIXED-CROWN* SUSPENSION** is safest on the outside, safest on the inside. New suspension provides an extra margin of safety which is completely tamper-proof.

*Trademark



☑ CHECK ITEMS OF INTEREST

We will furnish further details

Check off the MSA products which you would like to know more about. Then tear out this page, send it to MSA. We will send you the additional information requested. An MSA representative will be pleased to relate the advantages of these items to your operation: in terms of full-shift protection, more tons per man. No obligation, ever.

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201 North Braddock Avenue, Pittsburgh 8, Pennsylvania

MSA® SAFETY EQUIPMENT HEADQUARTERS

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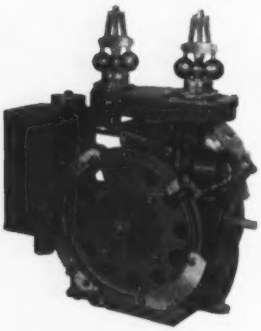
4901 W. Lawrence Ave. Chicago 30

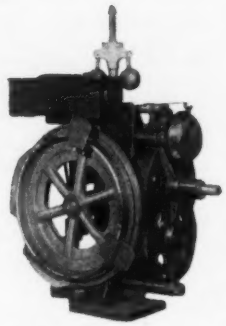
ILLINOIS

Automatic Safety Equipment for Mine Hoists, Hoist Recorders and Recording Tachometers, Brake Engines, Pressure Units, Aridifiers for Air Lines, and other Engineering Specialties



A MODEL C LILLY HOIST CONTROLLER with Duplex Governors. Model C Controllers are particularly suited to large and fast hoists. (See Catalog C-44)

A SIMPLEX HOIST CONTROLLER equipped with Depth Indicator and mounted on a Weight Unit with Regulating Cylinder for operating the brakes of small hoists. These units are best suited to small or relatively low speed hoists. (See Catalog S-46)



A MODEL D LILLY HOIST CONTROLLER assembled left hand. Model D Controllers are particularly suited to small or medium size hoists. (See Catalog D-44)

LOGAN HOIST RECORDER for recording all movements and delays of the hoist, and to provide a graphic picture of the manner in which it is operated. (See Catalog 447)

★ For over a third of a century Lilly Hoist Controllers have been used on mine hoists, and for over a quarter of a century they have been the standardized safety device used by the leading hoist manufacturers and in the greatest mining districts of the world. A superior line of hoist controllers and the service that we render in connection with them are the two factors which we are proud to say have made this line standard throughout the world.

If you have a hoist that is not equipped with Lilly Hoist Controllers, write us. We shall be pleased to submit our recommendations to you.

Lilly Controllers that have been in use for a long time can be overhauled and rebuilt at an economical price. We are prepared to do this job for you and equip the controllers with the latest improvements to provide the maximum safety, at the lowest cost.

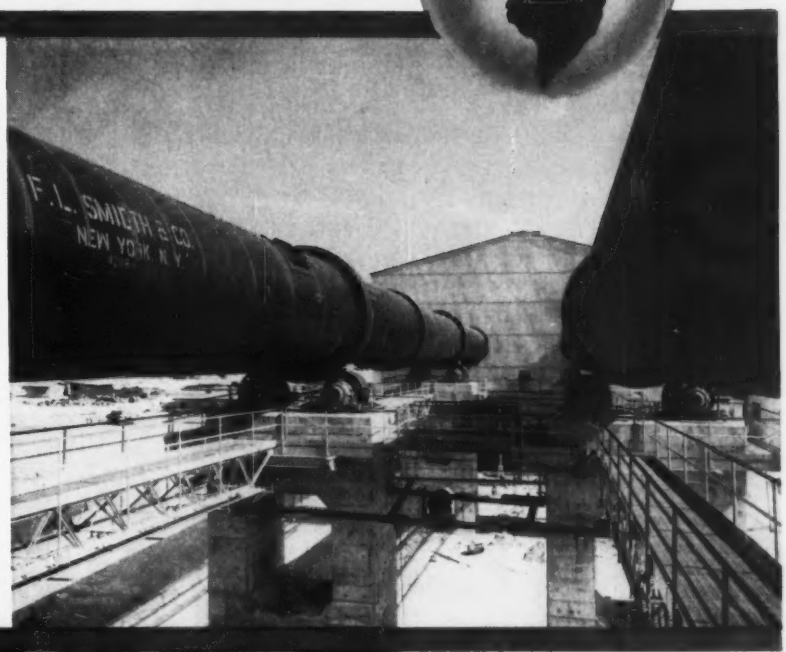
If you require instruction manuals, service bulletins, or service of any kind pertaining to automatic safety equipment for mine hoists, write us, and we shall be pleased to cooperate with you and assist you to the best of our ability.

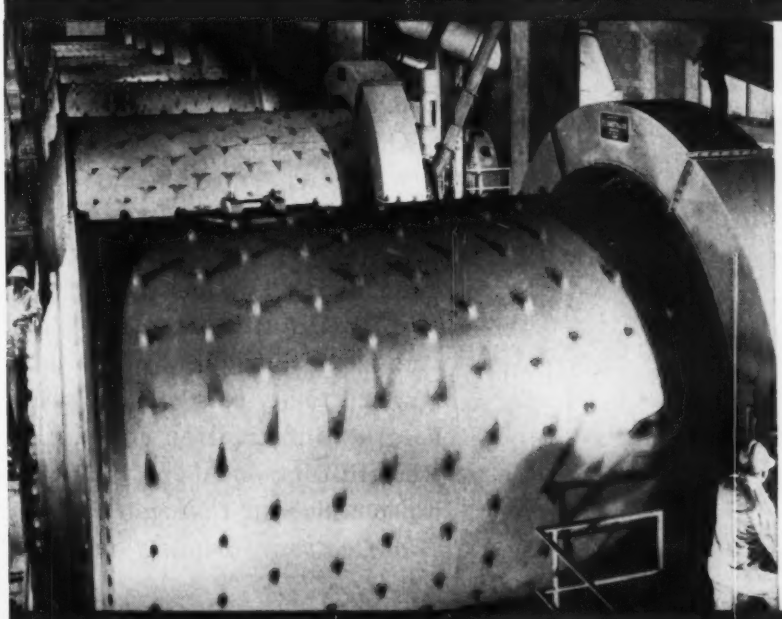
A MODEL D LILLY CONTROLLER, mounted on Weight Unit with Regulating Cylinder for operating the brakes of small hoists.

SMIDTH

rotary kilns

For sintering, nodulizing, calcining, desulphurizing, oxidizing and reducing roasting. Coolers, precoolers, preheaters, recuperators. Auxiliary equipment for Rotary Kiln Plants.





grinding mills

Ball mills, tube mills and multicompartment mills—open or closed circuit—wet or dry grinding. Also airswept for grinding and drying. Over 1250 Smidth Rotary Kilns and over 5000 Grinding Mills supplied all over the world.

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NEW!

REICHdrill T-850 Heavy, mounted on a large, off-highway truck. This Model is designed to drill 10⅝" blastholes in extremely hard formations. It is turbo-charged for high altitude service.

AN

Chicago Pneumatic has expanded its engineering and manufacturing capabilities by the acquisition of The Reich Bros. Manufacturing Company, Inc., with plants located in TERRE HAUTE, INDIANA and GLASGOW, SCOTLAND.

The acquisition of its new REICHdrill Division affords Chicago Pneumatic an unexcelled diversification in the field of drilling equipment.

REICHdrills, both truck and crawler mounted, are hydraulically-powered rotary blasthole drills. For detailed information concerning REICHdrills, or other CP Drilling Equipment, write *Chicago Pneumatic Tool Company, 8 East 44th Street, New York 17, N. Y.*

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ITS NEWEST MANUFACTURING AND
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DIVISION: CHICAGO PNEUMATIC TOOL CO., NEW YORK

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Cement Mill Elevators... 15 to 470 tons per hour

You get matched Jeffrey-built components throughout in Jeffrey cement mill elevators with engineering at its best for material handling systems. It's to your advantage to have one dependable source for design, manufacture and for guaranteed replacement parts.

Planning new facilities? Save both time and money by using Jeffrey's long-time application experience. Send now for Bulletin 950, or place a call for engineering assistance to The Jeffrey Manufacturing Company, 974 North Fourth Street, Columbus 16, Ohio.

A. Removable split hood for easy access to head section.

B. Traction wheel with renewable NI-HARD or hardened steel sectional rim.

C. Sealed heavy-duty antifriction bearings entirely outside of casing with dust seals around head shaft.

D. Dust-tight and weatherproof 10-gauge steel casing with reinforced corners. There's ample clearance between buckets and casing.

E. Increased capacity by closer bucket spacing. Lips and sides of buckets reinforced.

F. Equipped with heavy-duty steel knuckle chain assuring long life.

G. Large access doors for easy inspection and maintenance.

H. Internal gravity take-up assures constant and proper tensioning of chain and alignment of foot shaft.

I. NI-HARD or hardened steel sectional rim foot sprocket. Rim sections easily replaced when worn.

J. Cleanout doors at front and rear.

K. Steel bottom plate assures easy cleanout.

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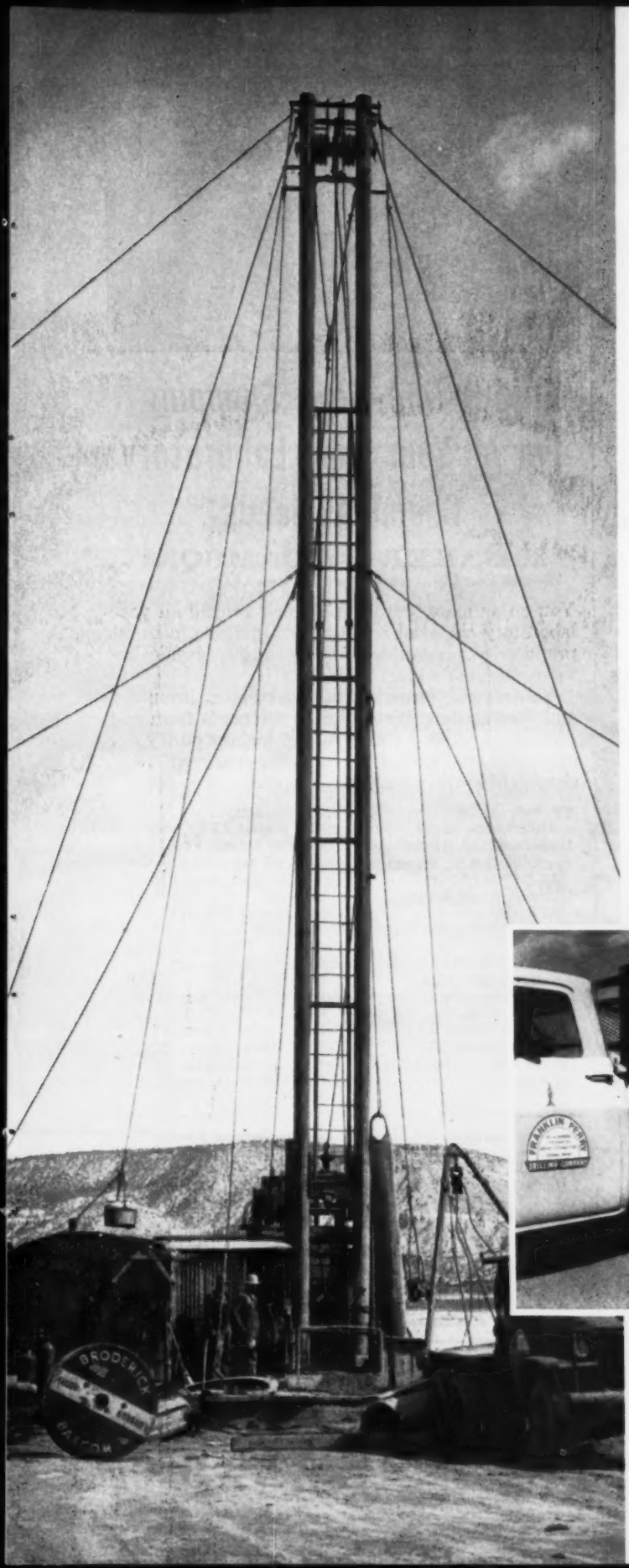


Yellow Strand BRODRIL drills

URANIUM ESCAPE SHAFTS

To punch 4′ holes ⅛-mile down into the largest uranium field in the world, Franklin & Perry Drilling Company, Ozona, Texas, put Yellow Strand BRODRIL to test. BRODRIL carries a 24″ spud to churn through the initial hole. Then it handles an 8,000 lb., 48″ reamer to finish drilling the giant-size shaft that is used for escape and vent.

1″ 6 x 21 left lay BRODRIL fiber core cable tool line is used on the spudder, and ⅝″ 6 x 7 Yellow Strand fiber core is used for the sand line.

"Our BRODRIL lines wear longer under the severe pressure, shock, and jarring pull-down than any other rope we've used," says E. D. Strickland, job superintendent.

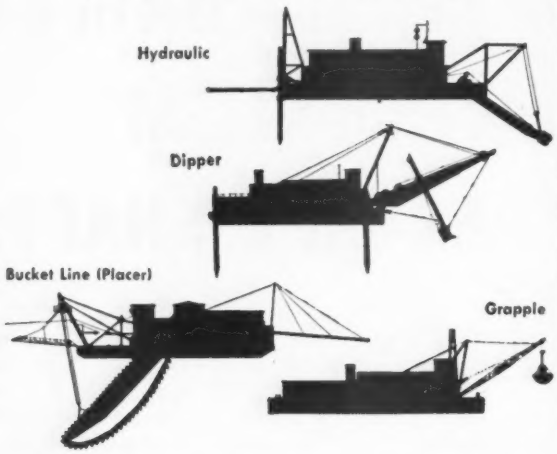
Tell your B & B representative to show you how the high abrasion resistance, resiliency, specially fortified fiber core and long-lasting lubrication of Yellow Strand BRODRIL can help hit the pay zone faster! Broderick & Bascom Rope Co., 4203 Union Blvd., St. Louis 15, Mo.

Yellow Strand®

WIRE ROPE SLINGS CLIPS

ELLICOTT DREDGES for Mining

4 basic types, readily adapted for mineral recovery



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May we share our experience? When your mining problems involve dredging, we can help you solve them. Ellicott is equipped to build hydraulically or mechanically operated units—of any size, type or combination—for mineral recovery. Our engineers are experienced in designing equipment for special applications. With this know-how, we can make completely unbiased recommendations, that will enable you to get the most economical and efficient dredging machinery for your individual project.

Ellicott engineers will work with you, *in strict confidence*, on preliminary studies or advanced projects, and provide expert service. Ellicott can also supply a full line of auxiliary equipment and spare parts. You will get the benefit of dealing with *one* company, with an undivided responsibility for the performance of all equipment.

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For full information on Ellicott dredges and dredging equipment for mining, write to

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FEATURES and APPLICATIONS

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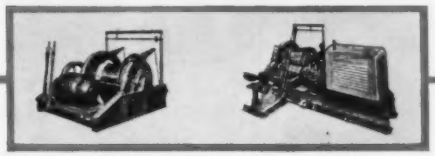
LIGHT DUTY HOISTS



Custom engineered to conditions, for installations requiring 1,250 to 15,000 lbs. rope pull. Choice of motive power, safety and electrical equipment. Dental or friction clutches. Air, oil or mechanically operated brakes and clutches.

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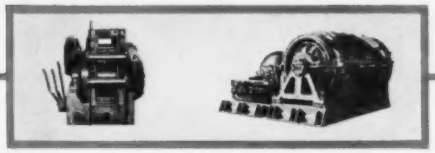
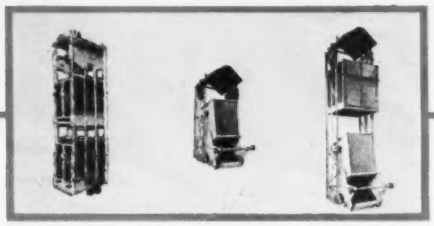
Famous for low maintenance and long life. These rugged little slushers are available in 10 to 75 HP sizes. Ball and Roller Bearing construction, sealed planetary gearing, heat-dissipating clutches. Built to any required production in single, double or triple drum models.

LARGE SLUSHERS



These 100 to 150 HP high capacity slushers are available in single or double drum models. Long used and continually reordered for large tonnage block caving operations. Wide choice in controls and features.

SKIPS and CAGES



Automatic bottom dumping skips are the coming thing. Vulcan vertical, self dumping skips or skip-cage combinations built to your requirements offer maximum strength and safety, high capacity-to-weight ratios. Vulcan cages are safe and easy running, available in various styles.

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Ball and roller bearing sheave designs with cast steel or Meehanite construction. Grooves flame hardened or with replaceable liners. Low inertia designs for all hoisting service.

Try this slope roller with replaceable rubber segments for heavy service. Cushions rope for longer life. Segment rings also in Neoprene. Alemite lubricated sealed ball bearings.

One-piece scrapers of manganese steel with replaceable liner. Built to match the service of large Vulcan slushers.

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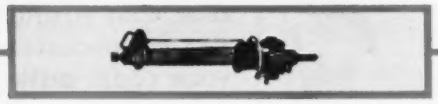

Widely used among larger underground mines. More than double the work capacity of ordinary chain saws. Built for long, trouble free service and easy handling.

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HERE IS THE VALVE THAT REDUCES ONE... ELIMINATES THE OTHER

the DeZurik Bonnetless Knife Gate Valve

The initial cost of a DeZurik Gate Valve is lower because of a more economical use of high alloys (only the wetted parts where erosion and corrosion resistant alloys are needed).

Maintenance costs are drastically reduced because DeZurik Gate Valves have no bonnet cavity where solids can pack, no cavity below the blade. They're light in weight, yet solidly built to withstand piping strain without binding. DeZurik Gate Valves have been used on cement, copper concentrates, mud, salt slurries, fly ash, uranium fines and many other rough services with excellent results.

For more information, contact the DeZurik representative near you, or write for Bulletin 300.

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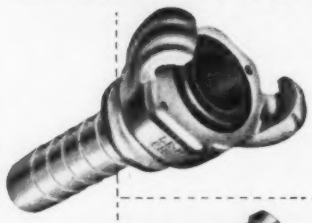

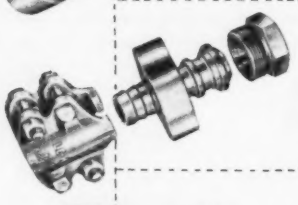

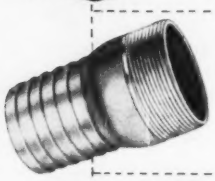

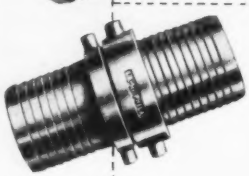

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Couplings, clamps, nipples, valves, manifolds, complete assemblies . . . in a range of sizes and types to meet specific performance requirements. Write for Bulletin 34.

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Coppus VENTAIR (centrifugal type)

Coppus VANO (propeller type)

Choose between them and get 30% to 100% more air

Coppus Blowers are designed for two different types of mine ventilation requirements: the centrifugal Coppus VENTAIR is for long pipe lines; the propeller-type Coppus VANO for shorter lines . . . the correct selection will give you from ⅓ more to twice as much air — for a given power consumption — than an ordinary all-purpose fan.

Available for either compressed air or electric motor drive, both can be used as blowers or exhausters and are obtainable in capacities up to 90,000 CFM.

Only Coppus makes both these types, one of which will give you better, more economical mine ventilation . . . know them by the "Blue Ribbon" that symbolizes the engineering and production skill behind every Coppus product.

Representatives listed in MINING GUIDEBOOK. Other Coppus "Blue Ribbon" products: steam turbines, gas burners, heat killers, air filters, blowers, and exhausters for special purposes. See also THOMAS' REGISTER . . . Coppus Engineering Corporation, Worcester 2, Mass.

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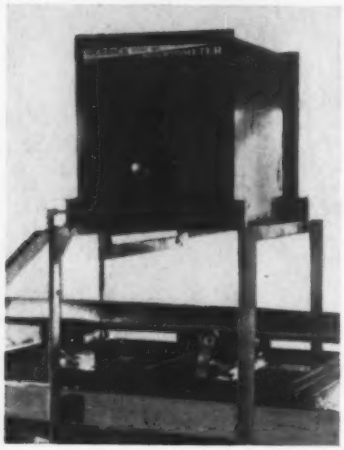
For accurate, continuous weighing and totalizing of ores and concentrates . . . the Merrick WEIGHTOMETER®

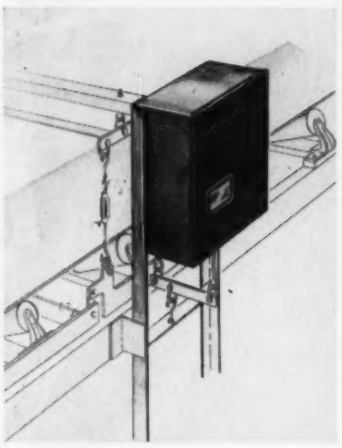


Type E Weightometer for heavy-duty, high-tonnage weighing

It's a simple matter to keep accurate records of the total weight of ore or concentrate passing over a conveyor when you have a Merrick Weightometer. Universally accepted and depended upon by the entire mining industry, each Weightometer is custom designed for its particular application.

Backed by more than half a century of practical experience and design advances, the Weightometer today offers the latest innovations in mechanical, electronic and pneumatic weighing and control arrangements. Optional pneumatic or electrical auxiliary equipment is available to make possible complete or partial automation of entire plant systems.

Merrick also offers the Feedoweight®, for blending, proportioning or feeding. Write today for complete information on either or both of these machines.



Type S-V Weightometer for mounting in restricted overhead or side space

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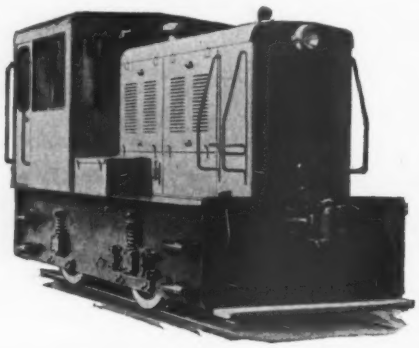

5 ton to 40 ton capacity. Track gauges 18" to 66". Powered by diesel or gasoline engines. Hydraulic or electric transmissions. Improved exhaust scrubber.

Unit steel welded cabs and frames. Locomotives designed to meet specific requirements.

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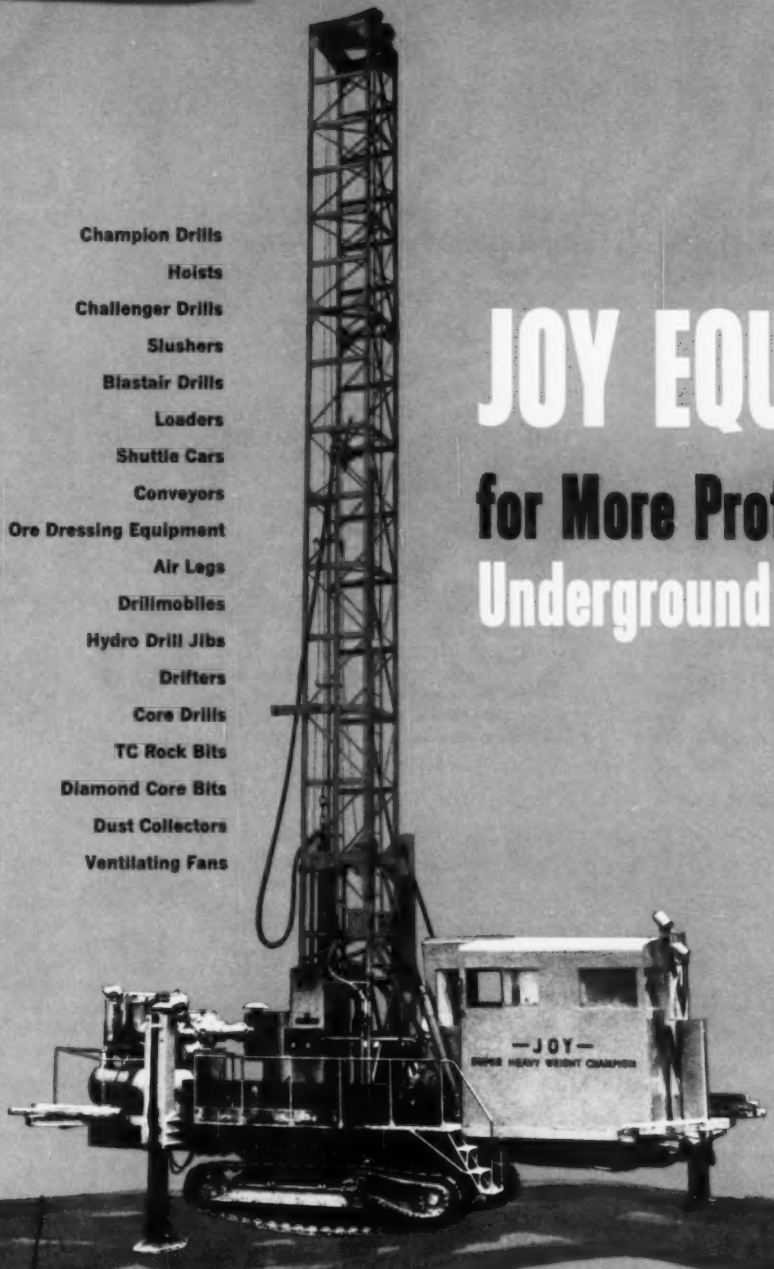
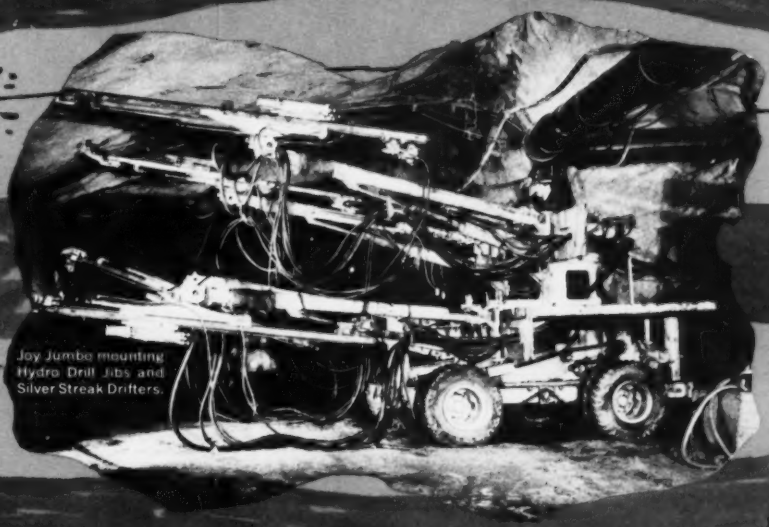
JOY EQUIPMENT

for More Profitable Mining Underground or Open Pit



The powerful Joy Champions are the most efficient self-propelled drills available for deep blast holes, and for the large blast holes required by modern blasting techniques. Four models of these rotary drills provide holes from 6¼" to 12" in diameter in any type of rock.

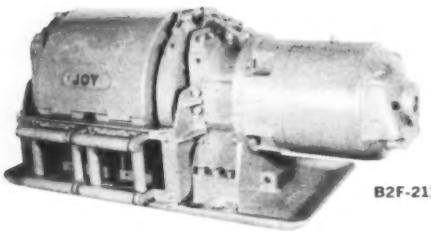
For fast drilling in difficult formations, Joy Champions can be equipped with the new Joy down-the-hole drill—the Downholer. Available in two models.



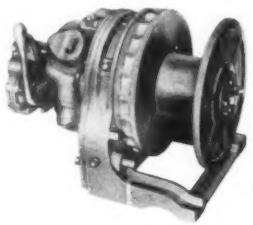
Joy Jumbo mounting Hydro Drill Jibs and Silver Streak Drifters.

JOY HAS THE RIGHT EQUIPMENT FOR MUCKING AND

Joy can furnish mucking equipment which will give the most efficient and profitable rate of production, whatever the mine conditions may be. From hoists and slushers to loaders and shuttle cars, Joy machines have the design features which make them outstanding performers in mines around the world.



B2F-211 Slusher

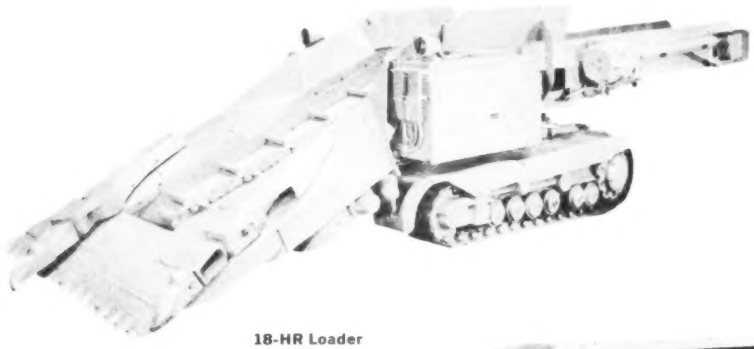


DW-111 Hoist

8-FS Sheave Block

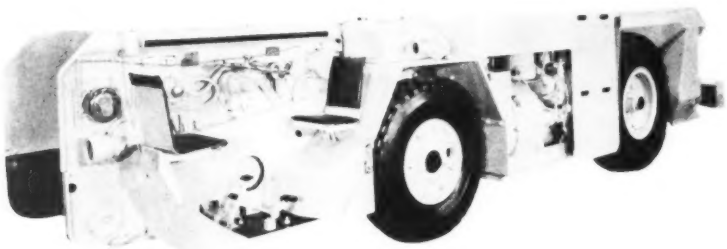
Joy two and three drum electric or air driven slushers range from 5 to 150 hp., with rope pulls up to 17,700 pounds. Single-drum, portable hoists with air, electric or gasoline motors have lifting capacities up to 5000 pounds. For details—Bulletin 76-J (Slushers) and 76-X (Hoists).

To work with the hoists and slushers, Joy offers a full line (6″ to 14″) of quick-opening sheave blocks in either open or shrouded styles. For details—Bulletin 76-D.

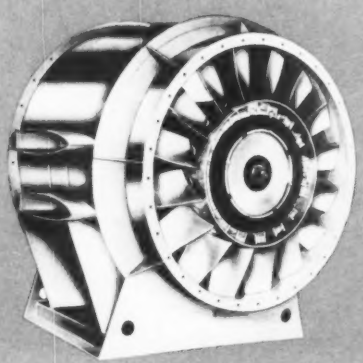


18-HR Loader

To move large tonnages, the Joy 18-HR Continuous Loader, with a rated capacity of five tons per minute, can be teamed with 60-E-12 Diesel-Electric Shuttle Cars, which can haul 14 tons of ore up a 25% grade, or other shuttle cars in the Joy line. This high capacity equipment is particularly suitable for bedded non-metallic deposits, but can be used to advantage in any shaft of suitable size. For details—Bulletin J-108 (18-HR Loader) and J-202 (60-E-12 Shuttle Cars).



60-E-12 Diesel-Electric Shuttle Car



JOY AXIVANE® FANS FOR MINE VENTILATION

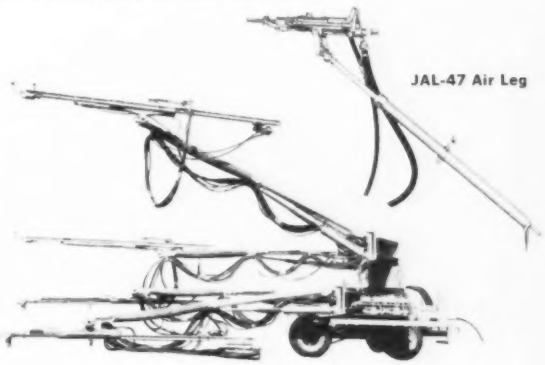
Joy Mine Fans are of the highly efficient vaneaxial type, and they offer the advantage of adjustable blades which permit varying air volume without altering motor speeds. Joy can provide both primary ventilation fans and portable blowers for auxiliary face ventilation. For details—Bulletin J-603.

DRILLING IN EVERY TYPE OF MINING OPERATION

Joy can provide anything in the way of a drill from hand-held sinkers to rotaries capable of putting down 12″ holes. More than 75 years of experience in building drilling equipment backs the Joy products, and the variety of types manufactured enables Joy to provide the best drill for every formation.

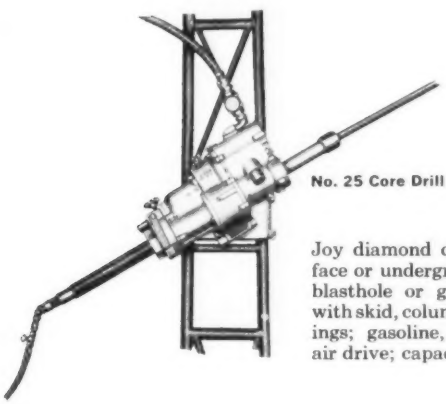
The Joy Air Leg has all controls grouped at the drill backhead for easy, one-hand operation. Air Legs are available with feed lengths from 36″ to 72″. For details—Bulletin 87-M.

The Joy Hydro-Drill Jib with hydraulic boom roll eliminates blind spots in face drilling and positions the drill to spot holes closer to rib, back or bottom. Hydraulic cylinders raise, swing and extend the boom and swing and dump the feed. The Hydro-Drill Jib can be mounted on tractors, trucks, mine cars, jumbos or Joy engineered chassis. It carries Joy drifters with cylinder bores from $2\frac{3}{4}$″ to 4″. For details—Bulletin 87-F.



JAL-47 Air Leg

Drillmobile



No. 25 Core Drill

Joy diamond core drills for surface or underground exploratory, blasthole or grout hole drilling with skid, column or truck mountings; gasoline, diesel, electric or air drive; capacities to 2250′.

TC Rock Bit

Diamond Core Bit

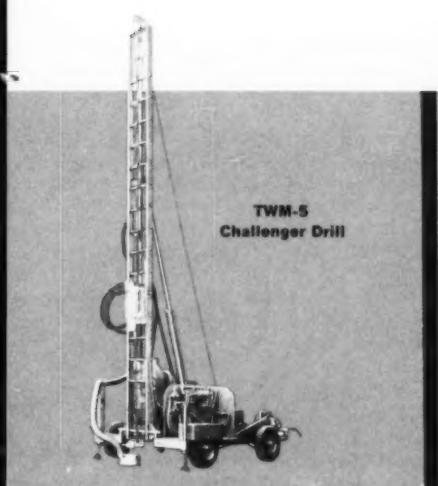
Joy TC Rock Bits are available in a full range of sizes in cross and X types; shoulder, bottom or taper socket drive. For details—Bulletin 87-C.

Truco diamond bits combine precise placing of diamonds with a wear-resistant matrix for maximum footage at minimum cost. For details—Bulletin D-18.

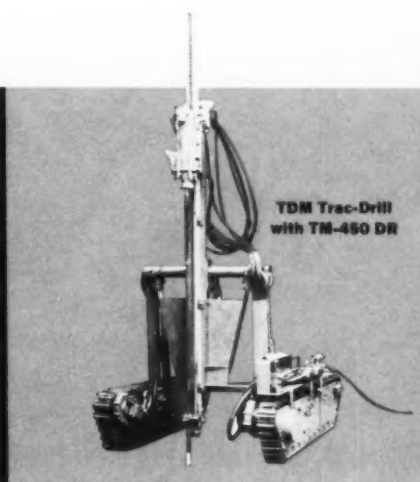
Joy Challengers are high performance percussion drills mounted on sturdy, self-propelled carriers. For mass production blast hole drilling in sizes from $4\frac{1}{2}$ to 6 inches in diameter, the Challengers have no peer. A variety of carriers permits selection of the equipment best suited to your operation.

The Joy TM-450-DR is the first percussion drill to provide rotation suitable both for fast steel changes and for rotating the bit in the hole when the drilling gets tough.

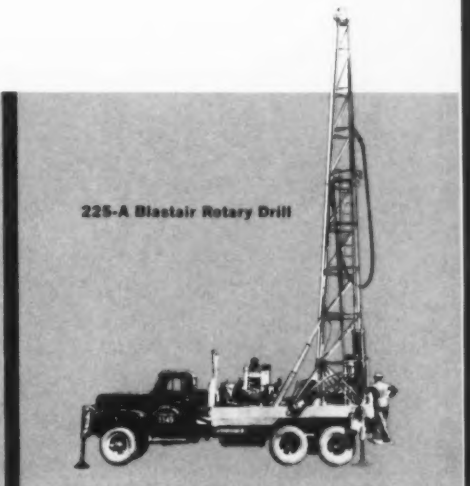
Joy Blastair Rotary Drills are fast moving rotaries capable of putting down deep holes from $4\frac{1}{4}$ to $6\frac{1}{4}$ inches in diameter. Mounted on standard truck chassis, these drills offer maximum speed in moving from job site to job site, and fast drilling on the job.



TWM-5
Challenger Drill

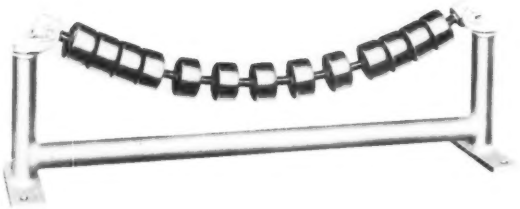


TDM Trac-Drill
with TM-450 DR



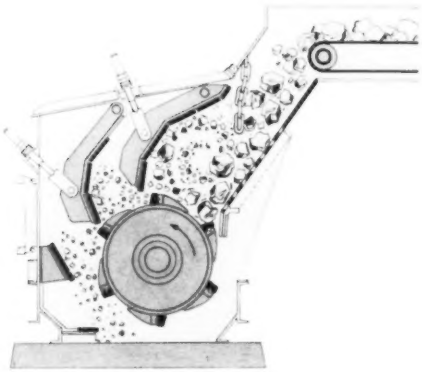
225-A Blastair Rotary Drill

JOY EQUIPMENT FOR ORE PREPARATION PLANTS



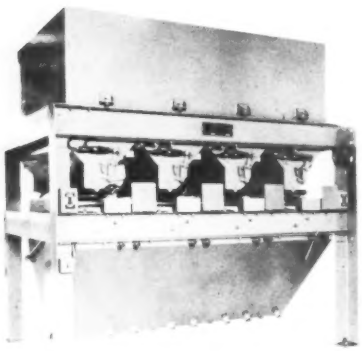
CONVEYORS

The Joy Limberoller Conveyor Idler has proved to give extra years of service under the most difficult conditions. Bearings are placed at either end of wire rope which has a series of molded-on neoprene discs. This construction makes the idlers easy to service, places the bearings where they cannot become clogged with spilled material from the belt, and makes the idler self-cleaning through constant flexing. For details—Bulletin LD-105.



IMPACT CRUSHERS

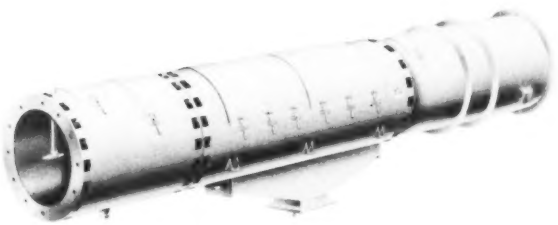
The Joy-Hazemag Impact Crusher permits selective crushing of ores without excessive fines. By varying the rotor speed and adjusting the position of the impact plates, material is crushed in a controlled spectrum of sizes. Available in 20 models ranging in capacity from 5 to 500 tons per hour, Joy-Hazemag crushers are ruggedly built for long service with a minimum of wear and maintenance. For details—Bulletin MD-101.



HIGH TENSION AND MAGNETIC SEPARATORS*

Joy High Tension Separators and High Intensity Magnetic Separators provide greater recoveries of ores at higher grades than spiral separators. Both types are dry processes, and they are particularly advantageous in cold climates. Joy separators cost less both to install and operate.

*Manufacturing under license from Carpco Research and Engineering.



THE JOY MICRODYNE® DUST COLLECTOR

The Joy Microdyne is a highly efficient dust collector for both underground and ore treatment applications. It will collect 99% by particle count of dust 5 microns or larger—92% of 2 micron size and larger.

Other advantages include compactness—it is 1/10th to 1/20th the size of conventional units of the same capacity—low water consumption and ease of installation. Microdynes are available in 2500 to 64,000 CFM capacities. For details—Bulletin J-616.

JOY MANUFACTURING COMPANY

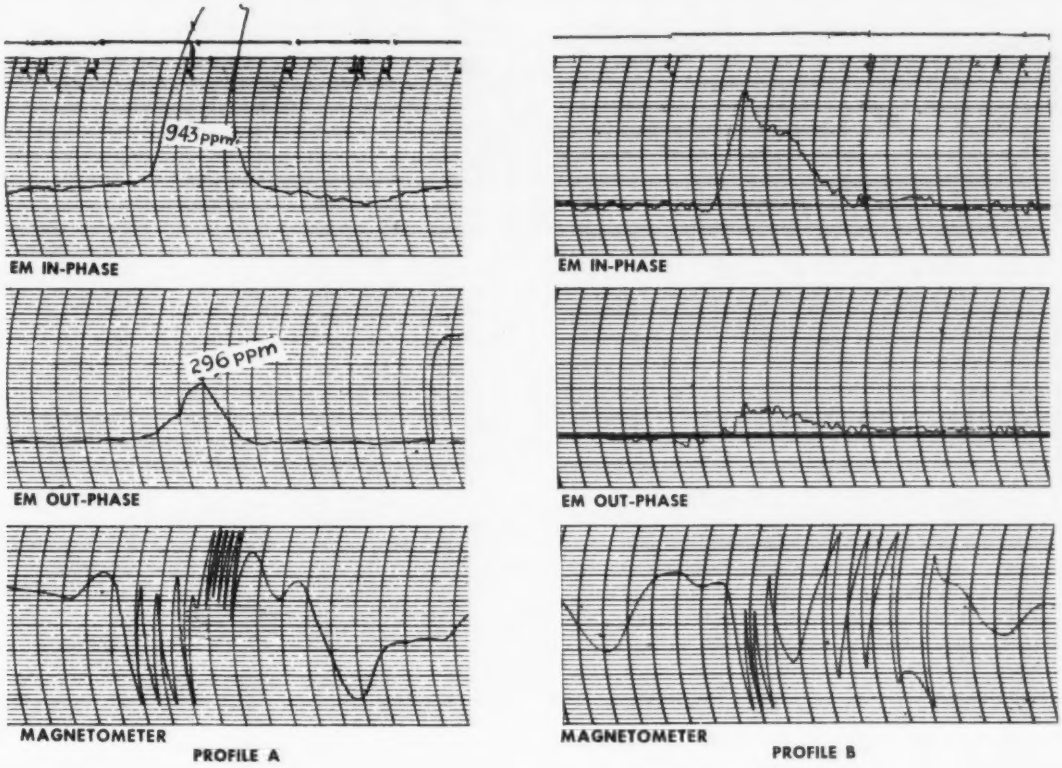
333 Oliver Bldg. • Pittsburgh, Pa.

Offices in All Principal Cities

Litho in U.S.A. WSW M7612-323

Bulletin M-223 10M—5050-9

E&MJ Mining Guide—Exploration



Science Speeds Search for Future Ores

A SURVEY of modern geophysical and engineering techniques, covered briefly in the following pages, shows that scientific advancements in the field of exploration have been as rapid as in mining and mineral processing. The Aero-Newmont electromagnetic surveying method is one of the newer boons to mining exploration. Note in the curves above which include an EM in-phase, EM out-of-phase, and magnetometer chart for two profiles over an orebody, how a deposit of nickel-copper sulphides was clearly indicated. The survey was conducted with a S-55 helicopter which can function at altitudes as high as 8,000 ft.

The new EM system can, to a large extent, differentiate between various types of conductors. This is especially important because the presence of graphite has led to a number of "false-alarm" searches where graphite conductors were present in the ground.

Direct correlation between EM results and magnetic results is possible because the variation in the total magnetic field can be recorded simultaneously with EM readings as shown in the profiles above.

The recording of radioactivity with a scintillation counter on the same record as EM and magnetometer traces is a useful aid in locating deposits of radioactive minerals, as well as assisting in the geological mapping of rocks and overburden in an area.

In Profile A, which encompassed a copper-nickel orebody in the Sudbury District, note the following:

1. The large, off-scale, in-phase response, whose magnitude is at least 943 parts per million, and the coincident out-of-phase response of 296 parts per million.

2. The ratio of in-phase response to out-of-phase response of 3.1 (943 ppm to 296 ppm).

3. The large (approximately 2,000-gamma) magnetic anomaly, evidencing the highly magnetic property of the conducting sulphide mass.

Profile B was flown at a higher elevation than Profile A, and crossed the body at a mean terrain clearance of about 225 ft. Note that the ratio of in-phase to out-of-phase is approximately 3.7, which is in close agreement with Profile A. The magnetic anomaly is also in similar magnitude, approximately 1,800 gammas.

Above information pertains to the Whistle Mine owned by the International Nickel Co. The property is located in the northeast corner of the Sudbury Basin. The orebody is a relatively small massive sulphide deposit, containing some nickel and copper sulphides (chalcopyrite and pentlandite, associated with pyrrhotite). The geophysical survey indicated minerals with good conductivity and magnetic characteristics which is in agreement with known mineralogy of the deposit. Charts, courtesy of Aero-Service Corp.

Litho in U.S.A. WSW M7612-923 Bulletin M-223 10M—5050-9

GUIDE TO DIAMOND CORE DRILL FITTINGS

				RANGES E		RANGES A		RANGES B		RANGES N		NOTES
(1)	CASING	Standard Pipe	ID	1½"	1.610	2"	2.067	2½"	2.469	3"	3.068	Subject to mill tolerance.
		Extra Heavy Pipe	ID		1.500		1.939		2.323		2.900	
	CORE BARRELS	Set Reaming Shell	OD	E	1½ ±	A	1-13/16 ±	B	2-1/16 ±	N	2-13/16 ±	Never standards and now obsolete.
		Set Core Bit	ID		15/16 ±		1-1/8 ±		1-3/8 ±		2-1/16 ±	
	DRILL RODS		OD	E	1-5/16	A	1-5/8 ±	B	1-7/8 ±	N	2-3/8	Ranges not integrated into a group.
(2)	FLUSH COUPLED CASING	Casing	OD	E	1-15/16 ±	A	2-3/8 ±	B	2-3/4 ±	N	3-1/2	Variable between manufacturers
		Coupling	ID		1-9/16 ±		1-15/16 ±		2-1/4 ±		3 ±	
(3)	X GROUP & DESIGN FLUSH COUPLED CASING	Casing	OD	EX	1-13/16	AX	2-1/4	BX	2-7/8	NX	3-1/2	DCDMA STANDARDS Ranges integrated into a group.
		Coupling	ID		1-1/2		1-29/32		2-3/8		3	
	X GROUP & DESIGN CORE BARRELS	Set Reaming Shell	OD	EX	1.485	AX	1.890	BX	2.360	NX	2.980	Former DCDMA* Standards. Now superseded by W Group. Ranges integrated into a group.
		Set Core Bit	ID		.845		1.185		1.655		2.155	
(4)	DRILL RODS		OD	E	1-5/16	A	1-5/8	B	1-29/32	N	2-3/8	
(5)	X GROUP M DESIGN CORE BARRELS	Set Reaming Shell	OD	EXM	1.485	AXM	1.890	BXM	2.360	NXM	2.980	
		Set Core Bit	ID		.845		1.185		1.655		2.155	
(6)	W GROUP DRILL RODS		OD	EW	1-3/8	AW	1-3/4	BW	2-1/8	NW	2-5/8	DCDMA STANDARDS
	W GROUP X DESIGN CORE BARRELS	Set Reaming Shell	OD	EWX	1.485	AWX	1.890	BWX	2.360	NWX	2.980	W Group completely integrated with X Group casing.
		Set Core Bit	ID		.845		1.185		1.655		2.155	
	W GROUP M DESIGN CORE BARRELS	Set Reaming Shell	OD	EWM	1.485	AWM	1.890	BWM	2.360	NWM	2.980	
		Set Core Bit	ID		.845		1.185		1.655		2.155	

EXPLANATION OF THE TABLE

Hole size is controlled by set reaming shell diameter; and core size by set core-bit inside diameter.

The nomenclature for diamond drill tools consists of one-letter, two-letter and three-letter names.

The first letter indicates the "range" in which the tool belongs. Range means an arrangement in order of diamond drill fittings, casing, core barrel and drill rod, designed to be used together, and having a range of diameters appropriately related to each other.

The second letter indicates "group" classification of the range. In an integrated group of diamond drill fittings, a hole drilled with tools in one range of a group can be cased and continued with tools of the next smaller range in that group. The group letter specifically designates all dimensions affecting hole size and nesting of casings.

The third letter specifies "design", those dimensions and thread characteristics affecting interchangeability of core size.

In two-letter names, the second letter serves to classify the tool as to design characteristics as well as group characteristics.

For more detailed information on diamond drilling nomenclature, the U.S. Bureau of Mines, with the cooperation of the Diamond Core Drill Manufacturers Association, is publishing a "Glossary of Diamond Drilling Terms."

Guide to Diamond Core Drill Tools

FRANK C. STURGES

IMPROVED DIAMOND DRILL TOOLS have greatly increased the efficiency of diamond drilling. To help the user recognize the opportunities available to him, the accompanying table was designed as a guide for the selection of diamond drill fittings. It shows, in the sequence of their development, diamond drill tools that have been given letter names, along with the dimensions pertinent to their use, and their current status in regard to standardization.

Mr. Sturges is vice president of Pennsylvania Drilling Co., and chairman of the Standards Committee, Diamond Core Drill Manufacturers Assoc.

Trends in Exploratory Drilling

Diamond Core Drill Manufacturers Assoc. has developed, and is now testing, a new design core barrel. By slightly decreasing core size, while maintaining external diameters of diamond bit and core barrel, a number of improvements can be obtained. Additional space between the outer and inner tubes provides better passage of water, and also of air and mud when they are used in the circulation medium. The increased Kerf permits ample thickness of all parts affected by the internal core lifter case type of design.

Diamond drills are now designed with a lower center of gravity by putting the engine down on the base skid to increase stability in moving and loading the drill.

The popular CP-55 blast-hole drills have been redesigned to provide more power and a reversible type motor.

Popularity of the combination auger, churn and diamond core drill has increased. A second model of the Testborer was introduced, with a hydraulic motor to decrease weight, lower the center of gravity, and provide a lower cost outfit for drilling with small augers.

Hollow augers, for use as casing for diamond drilling when the hole reaches bedrock, were redesigned to improve the means of coupling, and to provide reversible rotation to prevent stuck augers.

"Back-off" shooting, with Primacord has been used successfully to remove drill rods above stuck core barrels.

The trend has continued toward the use of quick-setting gypsum cements to cement caving drill holes, also toward the use of mud as a drilling medium to prevent caving. New core barrels being developed by DCDMA should accelerate the trend toward the use of mud.

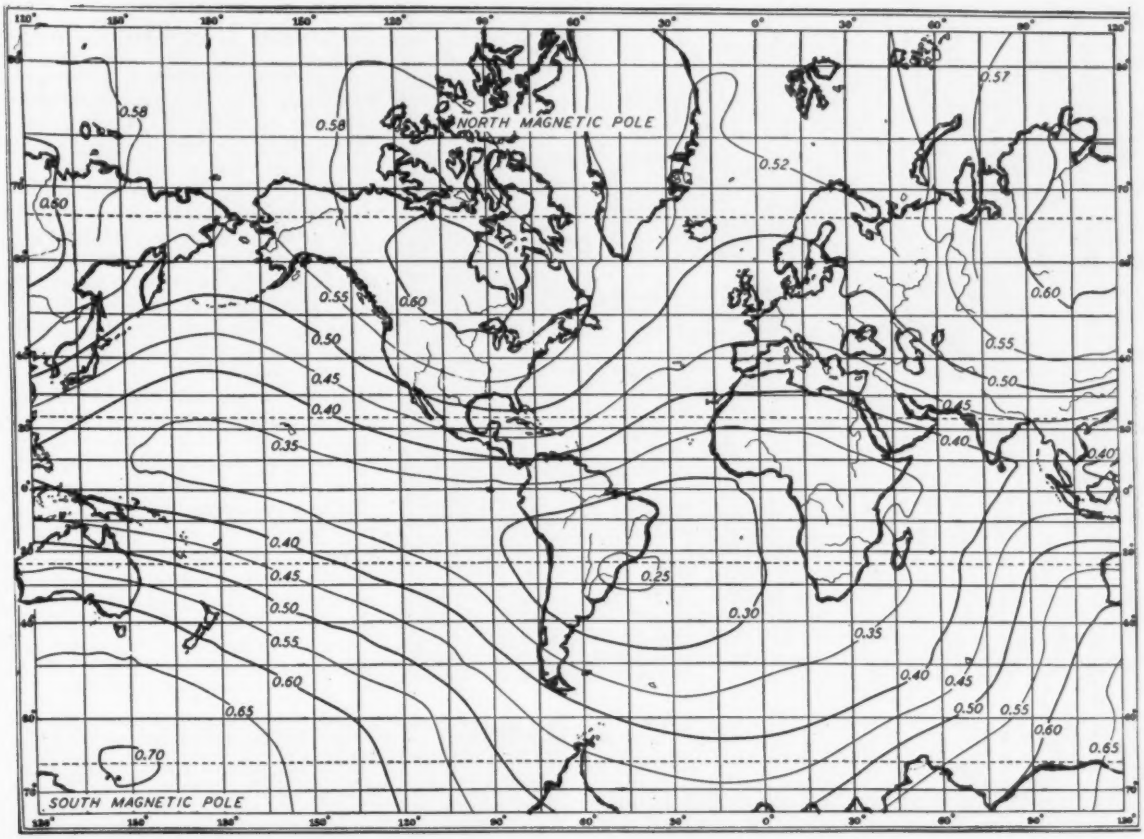
Wire-line corebarrel. Although originally designed to speed core pulling, it has since been demonstrated that the wireline unit also aids in core recovery.

A chrome-plated inner tube has been introduced to reduce friction and wedging.

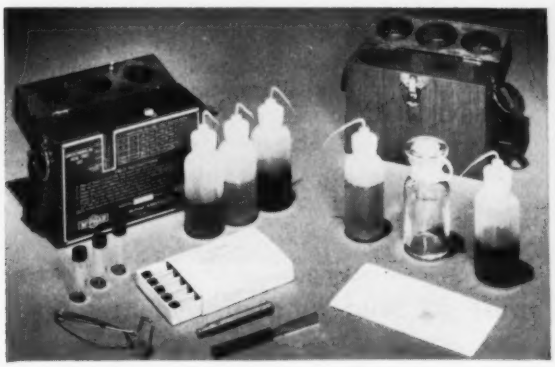
A pilot-type bit with no flushing-medium outlet on the tip of the pilot is used with a swivel-tube core barrel with straight walls and no core lifter.

A rubber-sleeved core barrel was discussed at a recent American Mining Congress meeting.

U.S. Bureau of Mines is experimenting with diamond bit design to verify indications that large high-grade diamonds in a round crown are most economical in sandstone, while small low-grade stones in a flat crown give lower costs in limestones.

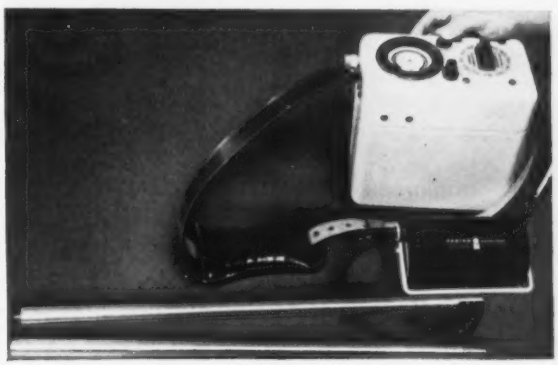


TOTAL INTENSITY OF EARTH'S MAGNETIC FIELD expressed in Gauss. One Gauss = 100,000 gammas. Thus, range of intensity shown on map is 25,000 to 70,000 gammas. Map is used to determine the range of sensitivity for magnetometers used in specific areas. Note position of Earth's magnetic poles. Map by Varian Associates.



Geochemical Soil Testing Kit

FIELD KIT, above, weighs three pounds. It enables the prospector to determine quantitative estimates as zinc equivalents of combined zinc, copper, lead nickel, cobalt, tin and silver contained in soil samples expressed in parts per million. Correct quantity of soil is measured in metal tube in foreground; then inserted in glass mixing tubes. Sequence and quantity of reagents to be added are prescribed on side of kit. McPhar Manufacturing Co., Ltd., Toronto, Canada, also makes a water testing kit.

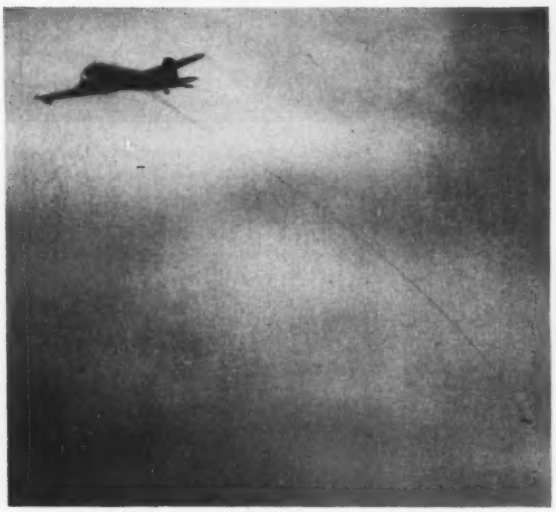


Lightweight Portable Magnetometer

THE ONE-MAN magnetometer weighing less than 20 lb can be operated by man on foot, on horseback or from a boat. It measures the earth's total magnetic field. Sensitivity is 10 gammas. Range of the unit is 19,000 to 101,000 gammas covered by eight range-extending, plug-in units. Map above shows ranges to be covered in various parts of the earth. Readings can be made in 6 sec. Orientation of instrument not necessary. The M-49 unit is made by Varian Associates, Palo Alto, Calif.

Regional Magnetic Survey

AN AIRBORNE GEOLOGICAL SEARCH of 60,000 sq mi of northern Ontario will be carried out in a survey jointly financed by the federal government of Canada and the Province of Ontario. Cost of the survey will be $400,000. Two twin-engine Cessna 310 aircraft, equipped with the Varian precession-type magnetometer, will be used in the survey. Changes in the earth's magnetic field will be recorded on punched tape and graph paper. In final form the survey results will be produced in 160 individual map sheets, each of which will be reproduced for delivery to the Ontario Department of Mines during the next 18 months. The maps will be made available to mining and exploration companies to assist them in their search for economic mineral deposits. Spartan Air Services, Ltd., of Ottawa has the contract to make the survey. The vast geophysical survey is part of Ontario's "Roads to Resources" program to develop the province's natural resources.



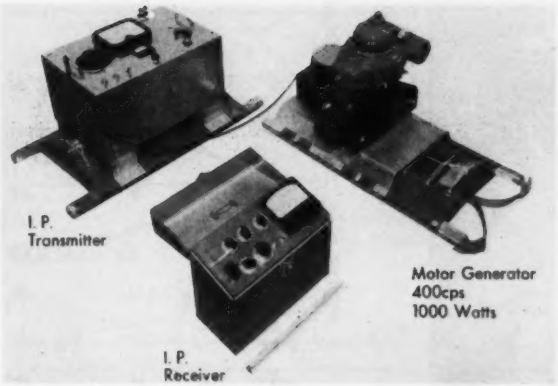
Regional Resource Development

UNDER THE COLOMBO PLAN, the Canadian Government provided $200,000 and the Malayan Government $150,000 for a combined air magnetic and radioactivity survey over six separate areas totaling over 15,000 sq miles. Canadian Aero Service, Ltd., and Spartan Air Services participated in this program to develop resources. Above is shown a DC3 and bird employed to make the survey. The question has been raised, in view of the Canadian Government's trend to help underdeveloped nations, why the various states of the U.S. have not taken similar steps to develop the deeply buried resources in their own borders with regional aerial surveys. Federation of Malaya has just released a full report of this survey.

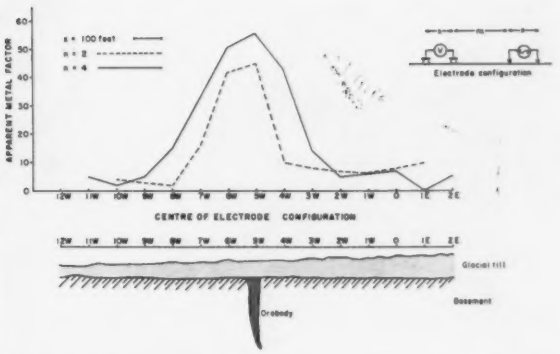
Profile of Modern Management

PHOTOGRAMMETRY is aiding operation of the 972-acre Bingham Canyon open pit. Survey data and complete contour maps are provided through aerial survey in about four weeks, as compared with five to six months by ground surveys. Advantages of this aerial engineering technique are: (1) management has a single cut-off date for inventory and pit planning, (2) areas can be mapped from the air which might be difficult and hazardous to ground surveyors, (3) engineering personnel are freed for other projects, (4) compilation can proceed without weather delays, and (5) costs are materially less.

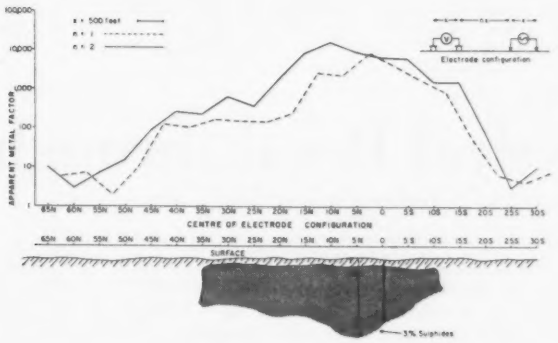
Above photo is one taken for this new engineering technique by Aero Service Corp.



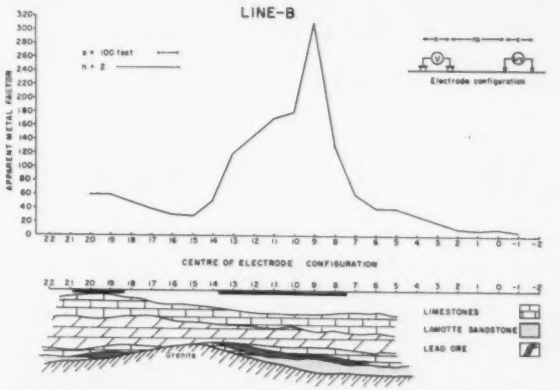
LIGHT PORTABLE induced polarization equipment includes a motor generator, transmitter and receiver (potentiometer.)



NOTE GREATER INTENSITY when interval between generator and receiver (V) is increased from 200 to 400 ft.



TWO-INTERVAL SURVEY over an orebody containing 3% sulphides shows the anomaly as "apparent metal factor."



SURVEY made with interval "n" of 200 ft produces sizeable anomaly over lead orebody in Southeast Missouri Lead Belt.

Induced Polarization Method Speeds Sulphide Ore Search

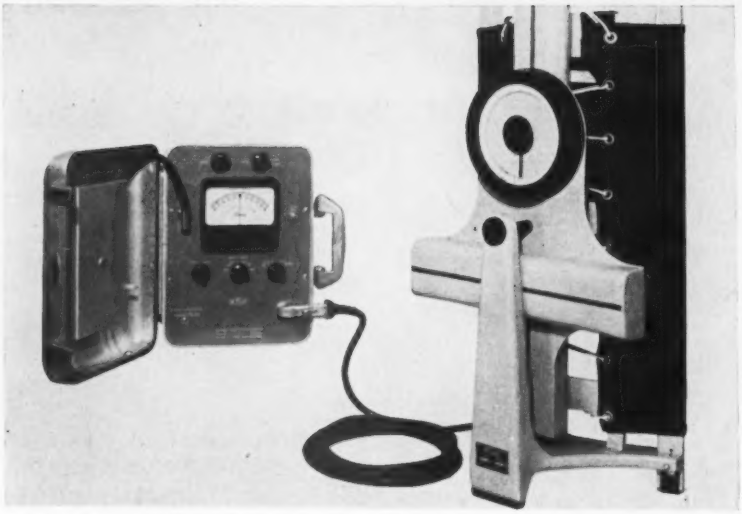
INDUCED POLARIZATION is a useful exploration method because of the extreme sensitivity of the equipment employed in the measurement of sulphide content in a rock. Lightweight equipment required for an IP survey includes a 1000-w, motor-driven generator, an induced-polarization transmitter and a receiver. See illustration above. As shown in the line drawings above, two electrodes of the generator are staked into the ground with a given separation distance "x." The receiver, which is in effect an extremely sensitive potentiometer, is also staked to the ground as shown with distance between the electrodes equal to "x." Distance between the transmitter stake and the receiver stake is equal to "x" or a multiple of "x" designated as "nx."

By increasing the distance "nx" it is possible to probe deeper into the underlying rock formations. Note in the illustration at upper right that the curve for the survey for n=2 is less intense than the curve for n=4 because the latter survey encompassed the sulphide zone at depth more completely.

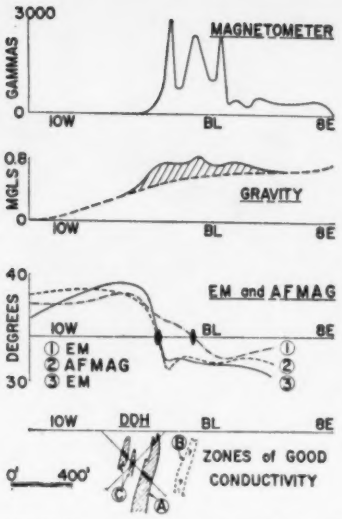
The principle of the method is as follows: Electronic or metallic conductors (sulphides) in a medium of ionic solution (i.e. in a rock mass) produce a blocking action to polarization when a current is passed through a mass. Electro-chemical polarization, called the "over-voltage effect" by electro-chemists, occurs whenever electrical current is passed through a volume of rock containing metallic minerals such as sulphides. This polarization at metallic interfaces in ionic solutions depends upon chemical energies necessary to allow the ions to continue the flow of current by giving up or receiving an electron from metallic surfaces. The energy stored up in this reaction is analagous to that stored up when a condenser is discharged. When the current applied to a rock mass is stopped, the polarization can be detected as a small decaying current that flows after the applied current is discontinued.

The equipment above, made by McPhar Geophysics, Ltd., Don Mills, Ontario, takes advantage of this phenomenon. Through a standardized electronic technique the instrument readings obtained in a survey are expressed in terms of an "apparent metal factor" which appears in the ordinates of the illustrations shown above.

Complete details of the induced polarized method with case histories are given in "The Uses of Induced Polarization in Mining Exploration" published by McPhar Geophysics, Ltd., of Ontario.



AMPLIFIER-DETECTOR UNIT, left, indicates a zero reading when the search coil unit is oriented in the plane of polarization. Receiving or search coils, right, have meter which indicates dip angle. McPhar Geophysical units.



AFMAG, gravity, magnetic, and electric-magnetic profiles over an area containing pyrrhotite stringers.[1]

AFMAG—A Geophysical Breakthrough

THE PRINCIPLE of AFMAG, involving the measurement of natural audio-frequency currents in the ground is described as follows:

"Natural magnetic fields in the sub-audio and audio-frequency range exist as rapidly and irregularly occurring pulses of short duration. These pulses can be considered to be made up of component pulses of narrow bandwidths at all frequencies. Hence it is possible to make measurements at any desired frequency. In base metal exploration the chosen frequency or frequencies of operation are those corresponding to fields whose amplitudes and directions are affected by hidden conductive mineral deposits, and are not affected materially by the overburden or host rock.

"In the absence of geologic conductors, the amplitudes and directions of the pulses tend to be somewhat random, except that there is little or no vertical component. However in the vicinity of highly conductive geologic features, the fields are less random. There they possess an increased amplitude, and appreciable vertical component, and definite azimuth of polarization. Therefore, in the normal state, an exploration coil will detect a very marked horizontal plane of polarization with a rather indefinite azimuth of polarization within the plane. On the other hand, near a highly conductive body, the plane of polarization if tilted out of the horizontal and the azimuth of polarization becomes more definite (the anomalous state). If the tilt of the plane of polarization is measured at successive stations in a survey, then the location of the conductor can be determined by the AFMAG method."

How AFMAG Is Used

In a survey, the equipment shown above is carried along successive traverses, perpendicular to the assumed geologic strike, and readings taken at appropriate intervals. The equipment is first used to determine the azimuth of polarization. Then tilt of polarization in the azimuth so found is recorded in terms of dip angles. The dip angles are plotted in profile form. These dip angles are accurate to plus or minus one or two degrees under normal operating conditions.

Advantages of the AFMAG method were given as follows in the Canadian Mining and Metallurgical Bulletin:

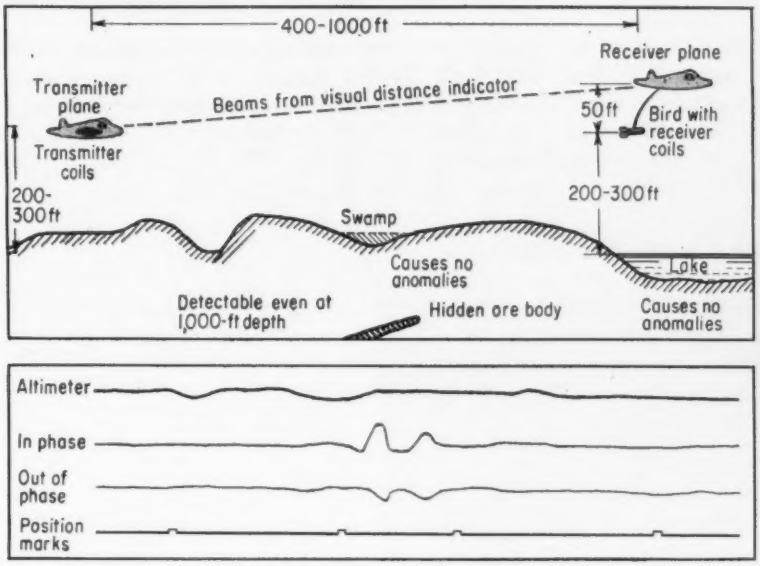
"The new method, which we will call AFMAG for identification purposes, is a simple method for measuring the electrical properties of the sub-surface at several audio or sub-audio frequencies. It has a much greater depth of exploration (and of course greater lateral range) and is less influenced by flat-lying surface conductors such as swamps and overburden than conventional electrical methods. In addition, it offers a marked advantage in facility for simultaneous measurements at several frequencies without bulky equipment. Production and cost rates for AFMAG surveys are improved over most other electrical surveys. Line cutting is not essential to performance of the survey, although it may be desirable for locational purposes."

A complete observation with AFMAG seldom exceeds two minutes at each station. Interpretation of data is fast and simple. The results obtained in the field are directly interpretable. No calculations or reduction of data are necessary. Stations of 200 to 400 ft, rather than the conventional 100 ft may be employed in reconnaissance exploration for massive sulphides.

References

[1]"Prospecting by Use of Natural Alternating Magnetic Fields of Audio or Sub-Audio Frequencies." By S. H. Ward, W. O. Cartier, H. A. Harvey, G. H. McLaughlin and W. A. Robinson. Canadian Mining and Metallurgical Bulletin, August 1958.

[2]"AFMAG, A Major Breakthrough in Geophysical Exploration Instrumentation." Published by McPhar Geophysics, Ltd., Don Mills, Ontario.



TWO PLANES are flown in tandem. Lead plane carries automatic recording equipment. The second plane, at same altitude as the bird, carries transmitter.

ENGINEER tests rotary-field amplifier before start of aerial survey.

Two-Plane Method Speeds Aerial EM Search

A TWO-PLANE aerial electromagnetic geophysical method has been developed by AB Elektrisk Malmletning of Sweden to speed aerial exploration and cut costs. As shown above, the lead plane carries automatic recording apparatus, the receiving amplifier, a navigator-instrument observer, and tows receiver coils on a 100-ft cable. The second plane flies at the same altitude as the bird, and carries transmitter coils.

With the rotary field system, orientation and spacing of the transmitter are not critical. Two rotating transmitter coils, mounted at right angles to each other, produce a circularly polarized electromagnetic field. When this field encompasses conductors in the earth, secondary fields are produced. The resultant field is detected by the receiver coils, and a record is obtained of the deviations from normal of the amplitude of in-phase and out-of-phase components of this field. These deviations indicate the presence of conductors as shown in the lilustration above. With this information, areas for detailed study can be selected.

References

"Some Practical Results of Airborne Electromagnetic Prospecting in Sweden." By G. Tornqvist, *Geophysical Prospecting*, Vol. VI (1958), No. 2. "Two Planes Speed Aerial EM Work", *E&MJ*, April 1959.

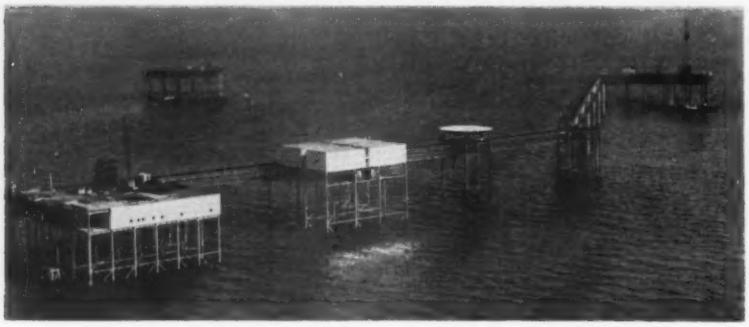
Surveying Speed-Up

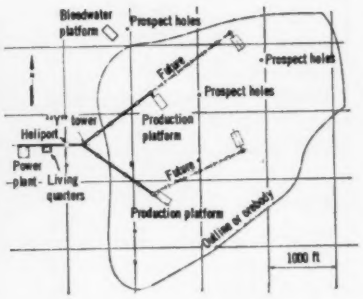
ADOPTION OF ELECTRONIC principles instead of light has been responsible for one of the fastest surveying instruments today—the Tellurometer. This electronic surveying device was used by Canadian Aero Service, Ltd., of Ottawa, to establish basic control data for an aerial mapping project at Wabush Lake, Labrador. Topographic maps for a 30,000-acre mining development and townsite were compiled at a scale of 1 in. = 200 ft, with 5-ft contour intervals. The survey work with the Tellurometer was done in mid-winter in sub-zero temperatures, with 5 to 10-mile shots over rugged bush country. Mapping was done for Wabush Iron (Pickands-Mather).

A Pictorial Review Of Mining Practice

AN INESCAPABLE REALITY OF MINING is the need to mine lower grade, deeper, smaller and more remote mineral deposits having less desirable ground and water conditions. There is also a growing need for rarer minerals and low-unit-value industrial minerals. And, of course, there always exists the need to cut costs and improve working conditions. In this section of the Guidebook, *E&MJ* presents some current practice, products and theories to help meet these needs. It supplements *E&MJ*'s Annual Mining Practice Review which was published in the February and March issues. It is obvious that the future is bright.

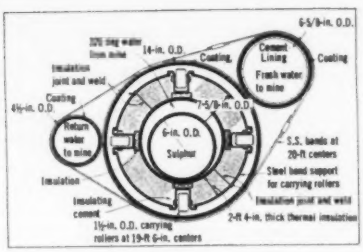
Wells Offer Interesting Possibilities

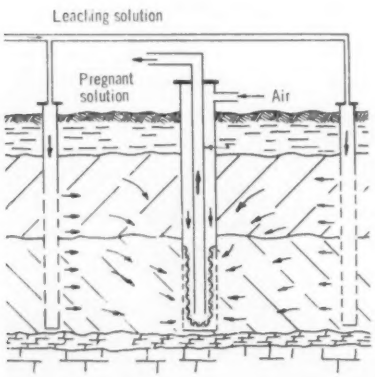


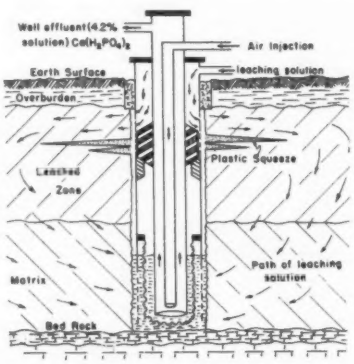


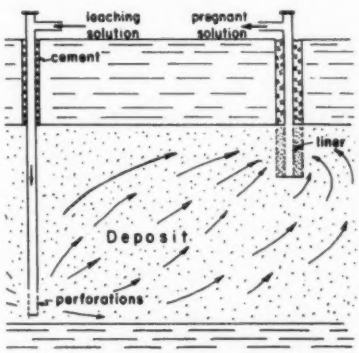
Off-Shore Sulphur Mine Under Development

SEVEN MILES from Grand Isle, Louisiana, and about 2200 ft under the 50-ft deep Gulf of Mexico, a sulphur orebody is being readied for well exploitation by Freeport Sulphur Co. Facilities are built on steel and timber platforms, supported 60 ft above mean water on pipe piles. From each production platform up to 12 wells will be in use at one time but 108 can be drilled directionally, three from 36 set-ups, to give a bottom hole spacing of 175 ft. Natural gas from a nearby well is the energy source for injecting 5-million gpd of 325 deg F seawater to melt the sulphur and 2500 cfm of 1000 psi air to lift it to surface. Spent cold water will be pumped out of wells on one flank of the orebody. Molten sulphur will be pumped to shore through an insulated submarine pipeline and barged from there to the Port Sulphur freezing vats.









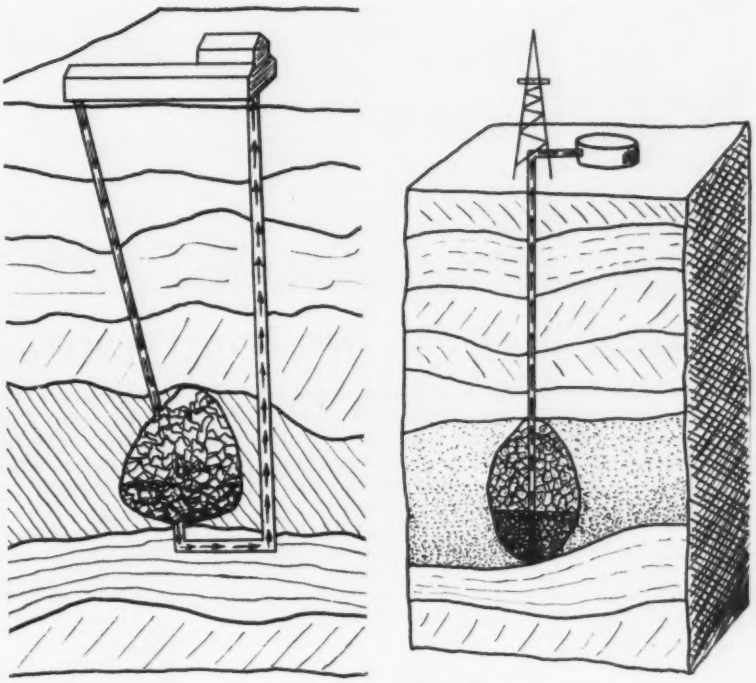
Better Phosphate Mining Is Suggested

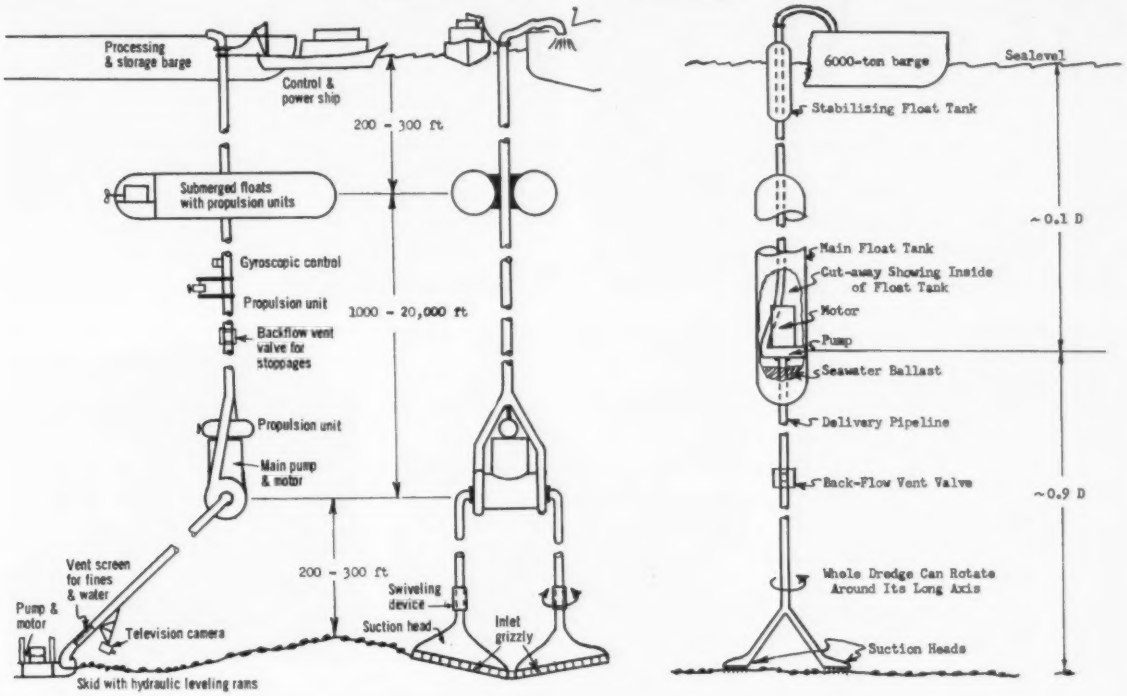
IN-PLACE LEACHING of phosphate deposits would cut slime losses and give a purer, better sized product at lower cost, according to S. J. Pirson's paper at AIME's February meeting. Multi-well pressure injection (left) of sulphurous acid — cheap and partially recoverable — is preferred to single wells (center). Gravity circulation is simplest (center) but reverse circulation with pressure (right) is needed for formations of low permeability, high slimes or high carbonate content. CO_2-saturated leach solution would cut consumption of acid by carbonates and could even effect gas-lift of pregnant solution.

Salt has long been mined using similar methods. But, of course, the leaching agent—in this case cold water—is quite inexpensive.

Nuclear Blasting Widens The View

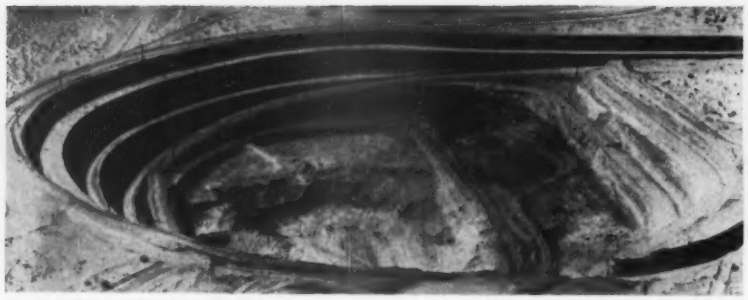
To break up formations and make them more conducive to leaching, the low cost of nuclear blasting deserves attention. Military devices less than 10-in. in diameter with energy equivalents of at least several thousand tons of TNT have been developed. With this small size and tremendous energy the explosive-emplacement cost is infinitesimal. Furthermore, the explosive cost itself may only be about $1 per ton equivalent TNT. So far, tests — in tunnels in silicate rocks— show radioactivity can be completely contained in a small volume of insoluble material. The heat produced could also be beneficial to leaching. G. W. Johnson, D. D. Rabb and H. Brown, all of University of California Radiation Laboratory, have sketched such possibilities (see near right sketch) and have also suggested it for oil shale and tar sands. (far right sketch)

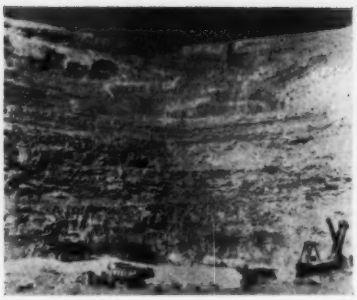




Well-like, Deep-Sea Dredging of Manganese Nodules Is Feasible

A WELL-LIKE scheme for hydraulically dredging manganese nodules from ocean depths of as much as 20,000 ft appears to be practical and low cost ($3 to $5 per ton), according to J. L. Mero in a report by the University of California. Two dredge designs are suggested. One (left above) would require improved submersible equipment for depths greater than 1,000 ft but would be maneuverable and controllable. A simpler system (right) has pumps in submerged vessel but would be less wieldy and give less complete recovery. Nodules, generally one to six in. in diameter, average 20% Mn and locally as high as 45% Mn.





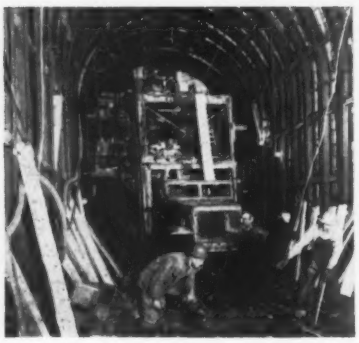
Surface Mining Grows Ever More Popular

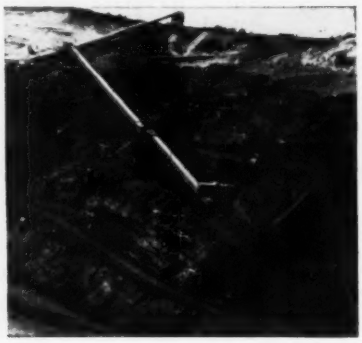
SURFACE rather than underground mining is a trend. U.S. Borax has converted from a highly mechanized regular-room-and-pillar operation to an open pit (above). Johns-Manville's asbestos pit (below) is expected to get a new lease on life in spite of a very efficient block-caving operation being conducted alongside.

Simpler and more flexible operations, especially with truck haulage as well as better working conditions are factors that make surface mining so much lower cost. More efficient earthmoving machines continue to be developed (see page 212) and further promote the trend.

Seemingly outrageous waste to ore ratios are often feasible. The 78:1 tonnage at Continental Uranium's pit in Utah (above) was justified primarily because it permitted more complete extraction of an irregular orebody. Lucky Mc uranium in Wyoming is planning for a similar ratio.

Depth of mining from the surface is increasing. The Pima copper mine (below) may eventually reach 800 ft despite its small horizontal area. Older pits are hanging on to open pit working longer than originally planned.

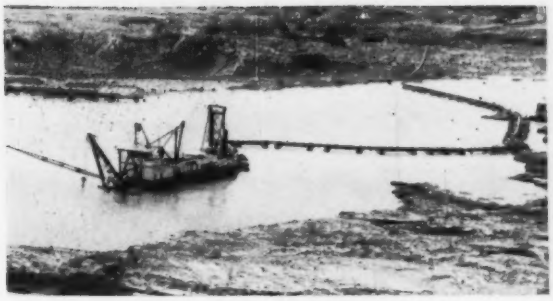




Tunnels, Skips and Belts Permit Steeper Overall Pit Slopes

RAIL HAULAGE undoubtedly gives the lowest transportation costs but low grades and wide benches are obstacles. However, Kennecott Copper is solving the problem with an 18,000-ft tunnel through the side of the Bingham pit (left). At Chuquicamata, Anaconda has chosen heavier 1750-hp diesel-electric locomotives that can cope with 3% grades. Mechanized trackwork is keeping costs down at many pits.

Truck haulage permits steeper grades and when combined with skip hoisting, such as at Pima (center), offers a solution that is being more widely adopted. A movable skip-loading station is often included. Truck haulage to a belt conveyor is an intermediate answer frequently used in the Iron Country (right). Good haul roads cut costs. Some are even paved (J-M pit above). Better ground control can also permit steeper slopes (see page 221).



Hydraulic Excavation Is Cheapest

A SIMPLE hydraulic monitor and an open flume is the ultimate in low cost mining—it is even used on coal overseas—but topography must be right. Suction dredges are an obvious answer to stripping a lake bottom as at Lake Asbestos in Quebec (above). The latter has a 7-ft dia toothed-auger head and a submerged 20x36-in. jaw crusher in the 30-in. suction line to break boulders to minus 18-in. In Britain, a rotating picked-disk head has been developed (Penfolds Ltd.), as well as a multi-nozzle water-jetting head (Acrow Ltd.) which is used on a dredge having a venturi pumping scheme rather than gravel pumps. Such hydraulic dredges are feasible for great depths.

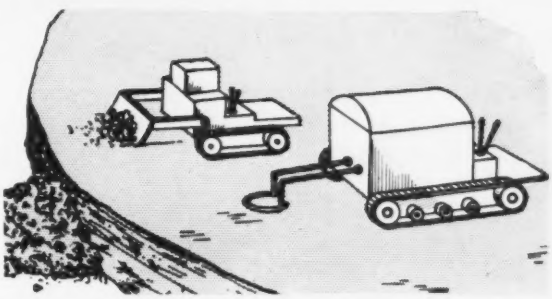
Continuous Schemes Are Coming

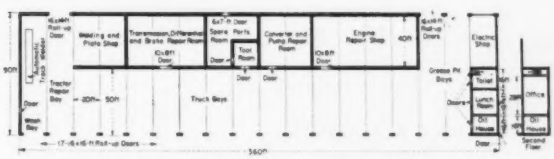
DRILLING and blasting can be eliminated even in some relatively hard rocks with ripper teeth mounted on new heavy tractors. Often scrapers can then be used, as at Pima (above). Dry dredges (page 213) are another approach in somewhat weaker ground.

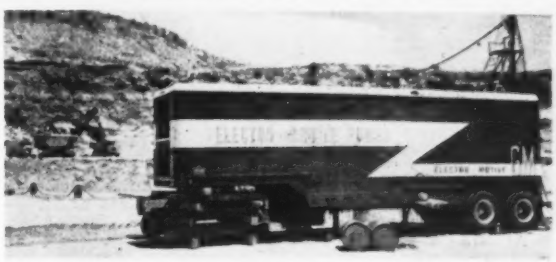
In a continuous operation a mobile unit (upper right) gouges out gypsum, crushes it to minus 1-in. and windrows or loads it into trucks for farm use at Holloway Inc., Wasco, Calif.

Massive 5-ft augers and continuous miners are already recovering coal at the toe of steep banks. Plans have been made to test an underground phosphate planer (see page 216) on a steep bank in a western U.S. pit.

An induction breaking apparatus (right) was recently patented for taconite mining in U.S. and the Russians claim to have similar units operating in other rock.







Shops and Power Gets Attention

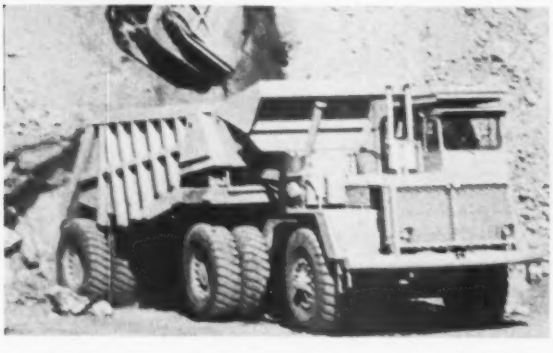
WELL-DESIGNED shops (Anaconda's Berkley pit, above), well-trained mechanics and rigid maintenance schedules are necessary elements of increased mechanization.

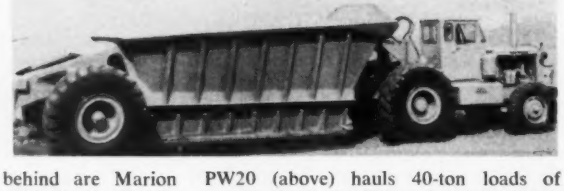
More efficient small power units cut transmission costs: trailer generator at Anaconda's Jackpile, (right); railcar transformer substation at Kennecott's Chino; movable air compressors at Asbestos Corp.'s Beaver.

Bigger Muckhandlers Cut Costs

The interrelationship between lower costs, higher production rates, bigger equipment and surface mining has been in evidence for some time. The size and cost of this equipment is staggering. Shown here are the largest capacity muckhandling units of their type known to be in use at the present time.

REAR DUMPS seem to defy logic as to how big they can get. Western Contracting Corp.'s 80-cu yd struck, 165-ton payload, 1,000-hp semi-trailer (above left) was built especially for the Oahe Dam project. Kenworth's 64-ton semi-trailer (below left) is used at Eagle Mountain. Euclid's 32-yd struck, 55-ton, standard frame model (above right) has two 336-hp engines. KW-Dart's 31-yd struck, 50-ton unit (below) is powered by a 600-hp engine.



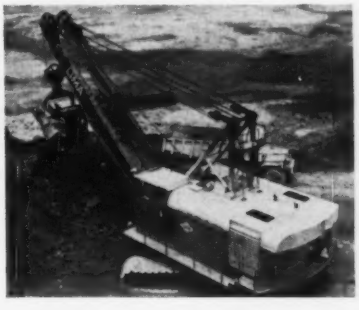


BOTTOM DUMP TRAILERS are topped in size by LeTourneau-Westinghouse's 100-yd struck, 80-ton, 450-hp coal hauler (above left). Close behind are Marion Metal Products' and KW-Dart's 70 tonners. At Bingham Canyon, an Athey PW20 (above) hauls 40-ton loads of overburden in its 27-cu yd struck hopper which is towed by a 345-hp Caterpillar.

SCRAPERS are led by R. G. LeTourneau's 130-ton total capacity tandem unit (above) which has a 600-hp diesel to generate dc for traction motors in each wheel hub. Next comes Curtiss-Wright's 39-ton, 36-yd heaped, 375-hp unit (above right); then Caterpillar's 34-yd and Euclid's 32-yd. Euclid's has 336-hp engines, front and rear.

SHOVELS of 8 cu yd capacity have proven advantageous for ore loading at a number of pits. Now 10-yd electrics, like Marion's above, are being eyed. Even 6-yd diesels are available (Lima, below center). In coal stripping, casting shovels are wielding buckets of 70 cu yd (Marion, below left) and 65 cu yd (Bucyrus-Erie) depending on boom length. Tractor shovels are becoming more popular and range up to 8 cu yd. (Wagner)

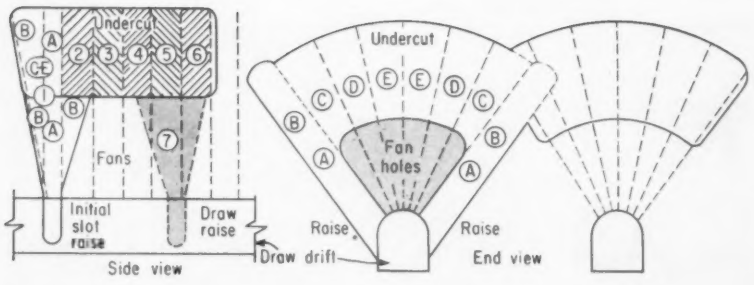
DRAGLINES of 35 cu yd are almost commonplace in coal stripping. A 30-yd bucket on a 200-ft boom is being used to strip on the Mesabi iron range (above, Bucyrus-Erie), and a 26-yd Marion is used in Florida phosphate. In Britain, a Ransomes-Rapier stripping unit (below) handles a 20-yd bucket on a 282-ft tubular-member boom at an iron pit.

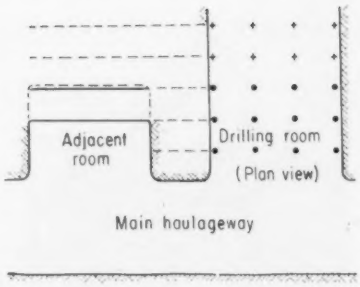


BUCKETWHEELS are fast strippers, e.g., Lubecker Maschinebau's 10,000 cu yd per hr unit for German coal (above) and a 2,000-yd unit for Nchanga copper in Rhodesia. Krupp is building one rated at over 15,000-yd and several U.S.-built, 1,500-yd units strip coal in Illinois.

BUCKETLINE DREDGERS (above, Lubecker) will hit the 2,000-yd size when Buckau Wolf fills an Australian order.

FLOATING DREDGES of the hydraulic or suction type have proven a cheap means of stripping alluvium, e.g., Ellicott's 3,700-cu yd per hr, 36-in. unit at Steep Rock iron in Ontario (above). A Russian bucketline gold dredge (right above) is reported to have 21-cu ft buckets and a digging depth of 164 ft. In U.S., Yuba expects to build an 18-cu ft, plus 150-ft unit and has completed design of a 54-cu ft, 145-ft broken rock dredge.





Underground There's a New Look

THESE are some of the methods that are making underground work more efficient, easier and safer. Truck and/or belt transport are used in several of these schemes in line with a general trend toward more flexibility. All-mechanical methods are becoming feasible for harder rock (see page 216).

More efficient drilling and blasting is getting attention. To undercut caving blocks, vertical fans are drilled from the draw drift at Cleveland-Cliffs Iron (above). Somewhat similar is the parallel scheme developed by Janelid and Olsson in Sweden (right).

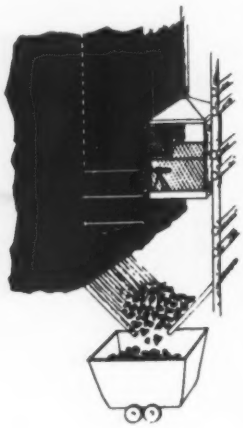
A longhole sublevel method is applied to shrinkage work at Broken Hill (bottom right).

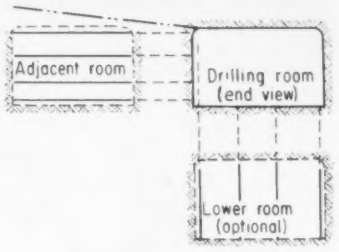
A low-cost shrinkage method is practiced in a thick at orebody at Tri-State Zinc (bottom left).

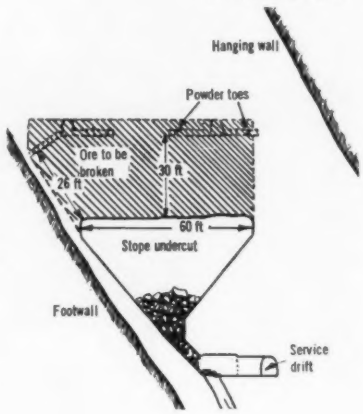
Cage-stoping (left) is a work-saving German innovation by Stoces. It also illustrates vertical slicing, which gives better ground support.

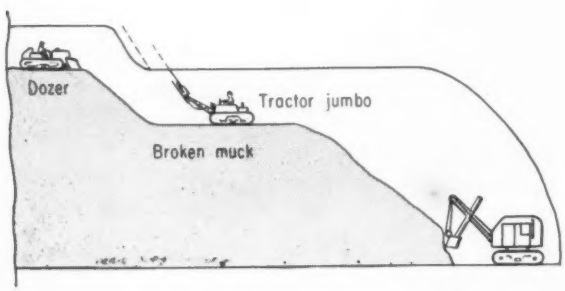
Britannia's coyote-like powder-blasting (mid-right) uses little powder.

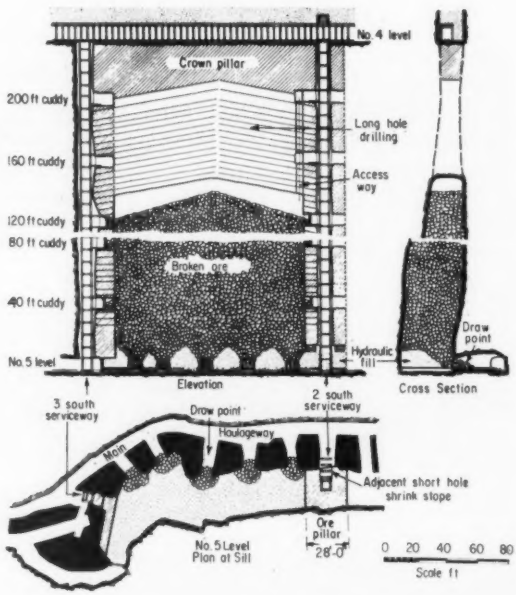
Longwall caving with steel props (lower left) gives complete extraction for Hecla in uranium.





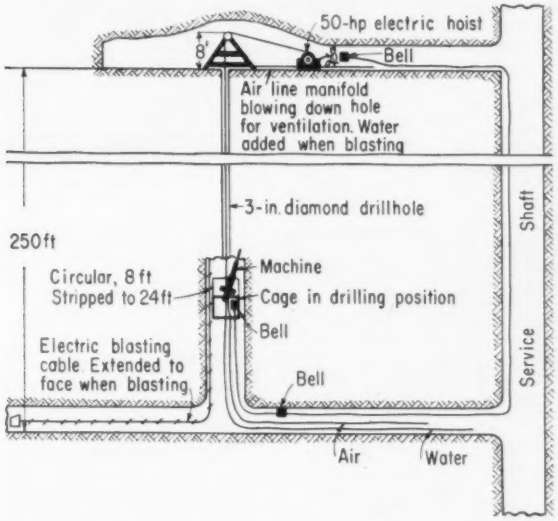


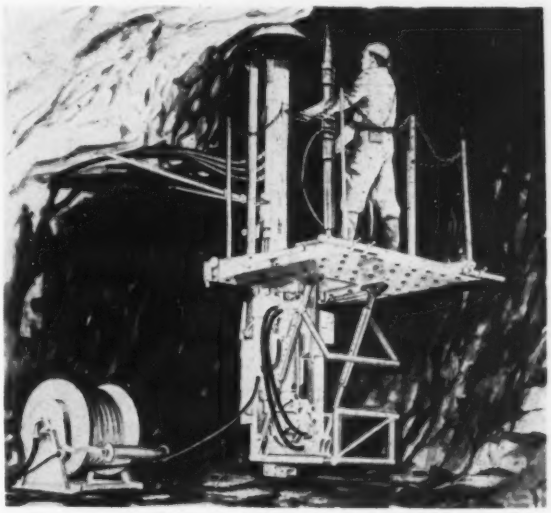




Hydraulicking Goes Underground

WATER-JETTING schemes of mining are attracting attention. There is no wear of a mechanical cutting element, power is applied directly and materials handling is simple. American Gilsonite, in Utah, developed a rig having small nozzles and using 2,000-psi water to drift mine the brittle, flammable hydrocarbon (left). A surface-type placer monitor is being used for a caving scheme in a decomposed dike containing base metals at Silver Butte Mines in Montana (right). Using similar units and 500- to 1,500-psi water, coal is mined in Russia, Australia and Great Britain. Many other operators are considering it also.

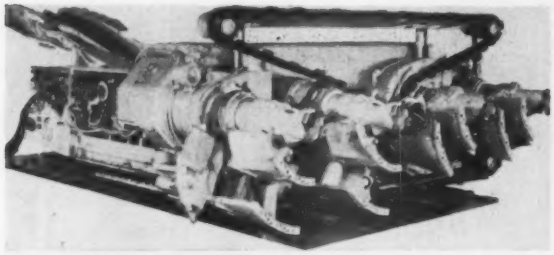


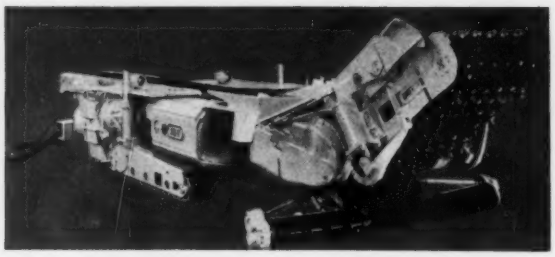


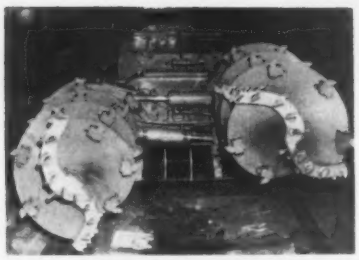
Cage and Platform Work Increases

CAGE-RAISING is being practiced at more and more mines around the world (above left, Nkana copper). For inclined raises, skids have been used at several mines. The Alimak raise-driving platform-elevator (above right), developed in Sweden, runs on a cogged monorail pinned to one wall and can be extended to any length, vertical or inclined. To gain access to high backs, a number of aerial towers are in use (left, Rogers Iron Works; right, Pitman Mfg). Front-end loader buckets are often used for medium high backs. Long-reach, remote-controlled drill-booms are also popular.

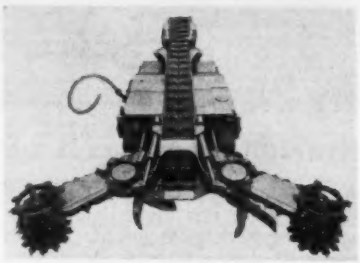
All-Mechanical Excavation Expands Underground

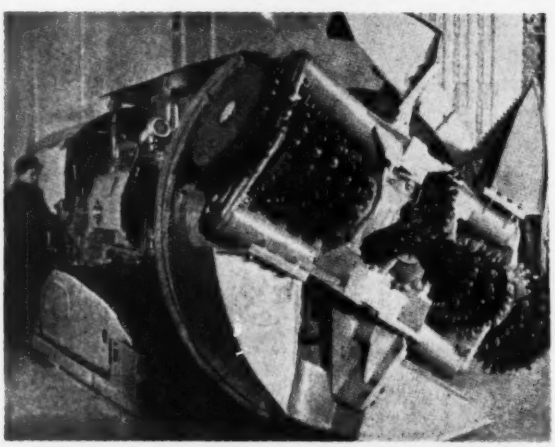


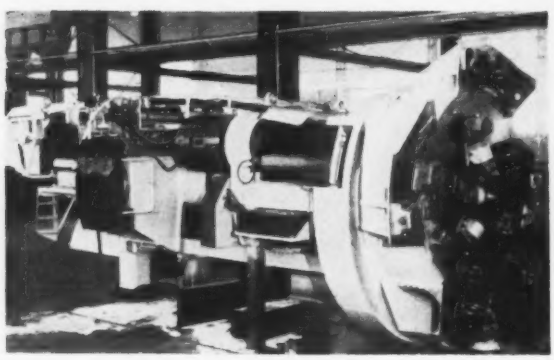


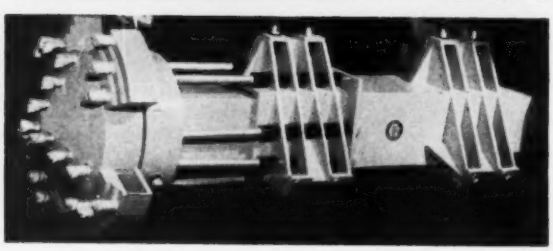


PRODUCTION UNITS of the "borer" type continuously scrape concentric grooves from which the intervening lands are wedged-off by the base of the tooth-holder (top left, Goodman's adjustable height model). Some are full face cutting without wedging elements (left, Wilcox; also Jeffrey's Colmol) one of which is a barrel auger coring device with a long reach (below left, Ca. I-R). To shave-off a single long wall, a rope towed "planer" having air-picks on the cutting edge has been used in dipping phosphate rock (lower left, USBM-Montana Phosphate). "Rippers" use an intermittent picking action of teeth on a chain or drum which moves across the face (top right, Joy; right, Lee-Norse). Drum-type rippers have also been used for longwall work. The Russian PKG-2 tunneler (below right) has ripper drums arranged like a huge two-cone roller bit. A locally-built bucket-line digger (at the right) is being used by Amo Placer in California, for placer drift mining.

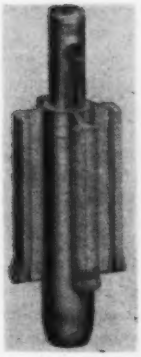


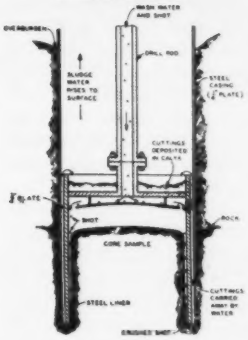




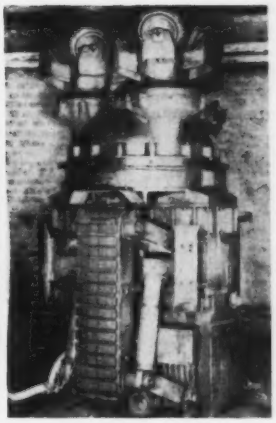


TUNNELERS for harder rocks include the 8- to 26-ft dia Robbins (left) with notched-disk cutters—now making over 10 fph in hard sedimentaries—and the proposed Hughes roller-cone-bit cutter unit. On both, entire head rotates.

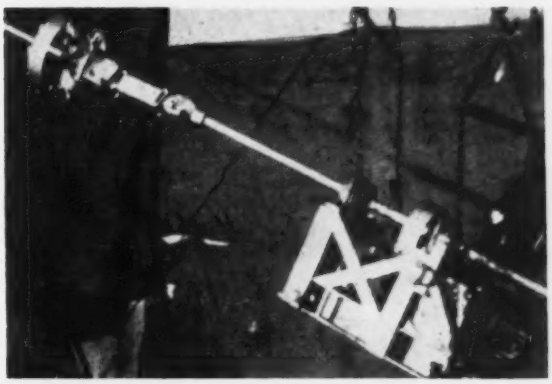


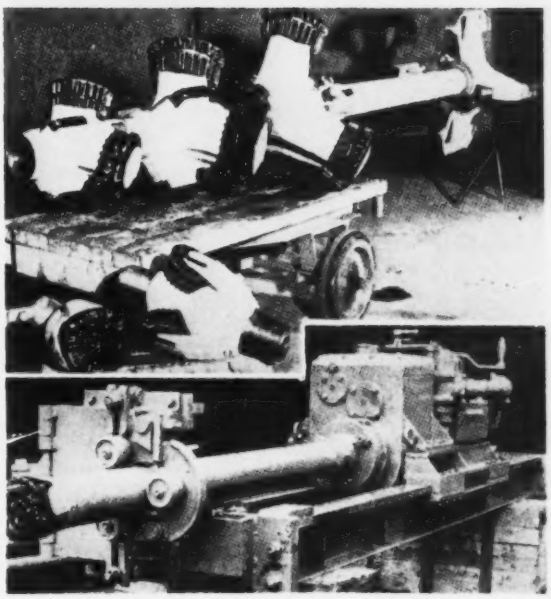


SHAFT SINKING APPARATUS has grown up from the granite-cutting, 48-in. churn drill reamers (top left, Spang) and 6-ft rotary calyx shot corers (left, Ingersoll-Rand) to the faster but softer rock cutting, 46-in. rotary drag bits (above right, Grant). However, larger diameters in hard rocks appear to need rotary roller-cone units like the 8-ft Zeni corer (bottom left) or the 42-in. Lane-NY full-face cutter (below right), especially if tungsten carbide button roller cone bits (p. 217) are used.

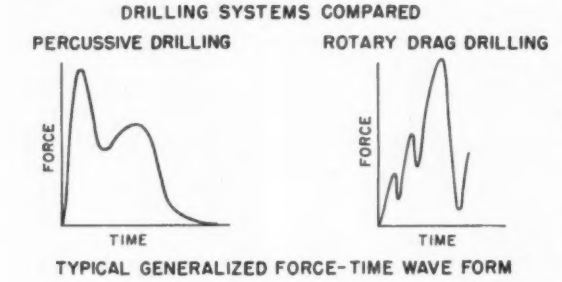


RAISING MACHINES of the pull type require a pilot hole. Salzgitter's (above left) uses drag teeth to cut a core which drops out the bottom. It is rotated by a motor in a pipe that is pulled up a peripheral pilot hole. The Martin Borer (below) has drag teeth on radial arms as well. It is rotated from below. Bade's unit (above right) has roller-cone bits, integral motor and stabilizing crawlers. Nuesser-Graefer has a pushed unit with a reaming array of roller bits (bottom).





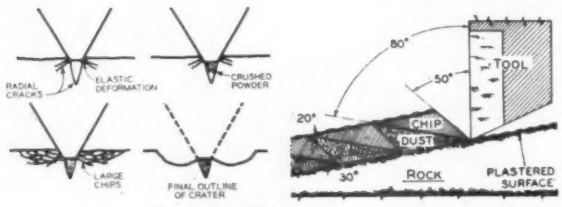
Drilling Developments Demand a Close Look



TYPICAL GENERALIZED FORCE-TIME WAVE FORM

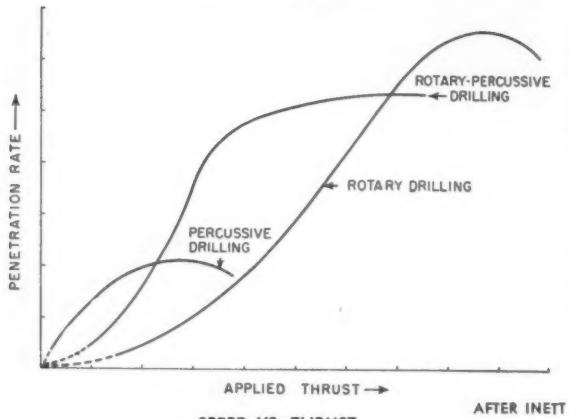
APPLIED FORCE SYSTEM ACTING AT BIT

AFTER FAIRHURST & LACABANNE



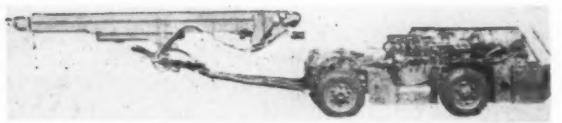
AFTER HARTMAN — AFTER GOODRICH

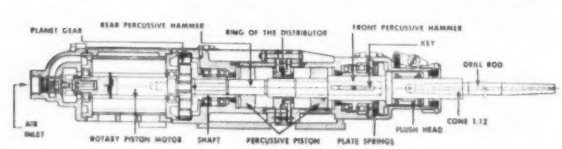
EFFECT ON ROCK



AFTER INETT

SPEED VS. THRUST





Research Unveils Rock Mechanics

STRESS TRANSMITTED to rock by conventional drills is essentially compressive and acts normal (i.e. 90 deg) to bit faces. Compressive stress component toward free rock surface causes free chips to form and is more efficient than crushing effect.

In percussive drilling, an axial impulsive blow causes a symmetrical wedge to penetrate rock by crushing and fracturing. Since during penetration bit load is essentially axial and since bit rotates to new site while free of rock during rebound after each blow, abrasive resistant carbides can be used with little disadvantage from tensile weakness. Acute wedge angle gives deeper penetration per blow and hence faster penetration but abrades faster than obtuse angle. Method is considered inefficient because: (1) percussive rock drill blows occur only every 33 ms while actual penetration takes only 1 to 3 ms; and (2) considerable crushing takes place which consumes more energy per unit volume than does chipping.

In rotary drilling, stress (torque) acts in direction more conducive to chip forming (i.e. toward surface) and crushing is slight. Although force is applied continuously, fracturing is intermittent (about 1000 to 2000 per min) giving rise to bending impact loads on bit tip which is disadvantageous for carbide inserts. Thrust, which is essential for keeping bit against face, causes high abrasive wear on under (or trailing) face and high frictional drag.

Because of its inherently greater efficiency, rotary drilling results in a faster penetration for a given power input. However, if other considerations—such as frictional drag with its associated bit wear and the means of producing thrust—are assessed, a rotary-percussion system appears to have most promise—especially in hard rock.

Rotary-percussion drilling, also called vibratory drilling, is essentially a rotary system having a high-torque and a high thrust, to which is added a percussive action which intermittently provides a sudden additional thrust. In true rotary-percussion drilling, bit rebound is prevented by the feed thrust and the bit remains in contact with the face at all times. Rotary roller cone drilling develops an essentially rotary-percussive effect. And even systems which are primarily percussive but which have a positive independent rotation also develop some of the r-p effect.

Flushing studies indicate advantages for: suction exhaust up the drill rod, e.g., greater velocity and, thus, carrying ability; and air as a medium, e.g., faster penetration.

These findings are resulting in new rock drill designs.

TWO DRIFTERS that are giving high penetration rates in hard rock are Joy's high pressure rotary (left) and Hausherr's rotary-percussion (below left).

Joy's HPD-1, widely tested, has drilled two to five times as fast as percussion units in the same ground. It is highly efficient, having an all hydraulic system powered by a 26-hp electric motor. Newer models are being developed now.

Hausherr's unit has had wide acceptance in Europe where speeds of five times plain percussion have been reported. It has a ¾- to 1½-ton screw feed thrust to which are added 6,000 percussive blows per minute. Rotation is controllable up to 200 rpm. The few models tested in North America have met with lukewarm acceptance because of high air consumption and the need for good mounts. These disadvantages are being tackled now. Similar units are being developed in the U.S.

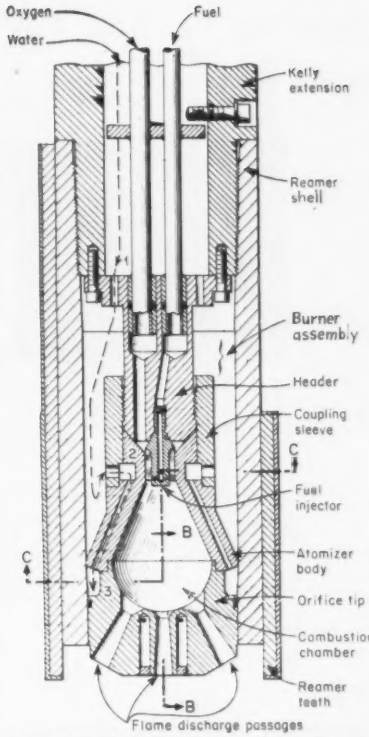
DOWN-THE-HOLE-PERCUSSION is a fast, cheap means of primary drilling at a number of pits, giving straight long holes even in very hard, broken ground. The devices are air-actuated and rotated by out-of-the-hole mechanisms.

Ingersoll-Rand units (left), up to 9-in. now, have proven themselves in all ground—from taconite blastholes to 575-ft waterwells and on flat holes, too. To actuate piston, air passes through flapper valve, then ports in cylinder wall. Exhaust plus direct air cleans hole. One-piece bit receives blow directly from piston with minimum energy-transmission loss.

In Mission's Hammerdril (center above), as air drives hammer down, finger below valve is uncovered. This allows air to escape down center of hammer to bottom, drive hammer up and vent out bit to clean hole. Sizes range from 4½ to 7 in.

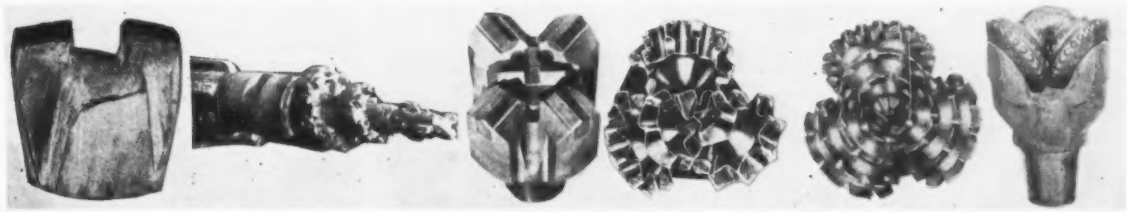
Junction Bit's Torkhammer (right above) speeds roller-cone drilling two to five times while extending bit life. It is especially useful for 6- to 12-in. holes in harder ground using lightweight rigs. Its spring-loaded piston operates by sliding over ports on the blow-tube.

Other manufacturers have also announced models for pit work (see Buyers Guide) and even a hand-held unit for small holes to 30 ft deep has been offered by Powermite (right).



THERMAL DRILLING is the only non-mechanical method other than water-jetting that has proved commercially successful so far; although sonically-vibrated abrasive slurries and direct sonic breaking are being considered, and schemes using electro-magnetic breaking (p 211) and electro-hydraulic (water) blasting were recently claimed in use by Russia. Linde's jet piercer (above) is a rocket-like device using kerosene fuel. It causes spalling of certain minerals such as quartz in taconite, and blows the debris out the hole. Churn and rotary rigs are used.

SECONDARY PIT WORK, as well as primary at smaller pits, is widely done with large drifters on crawler mounts that have towed or integral compressors. This has led to tractor-mounted drill-boom set-ups for block-holing and even platform booms (p 215) and cab booms (left, Travel Drill). Small 7½- to 15-lb air hammers are also handy for block-holing.



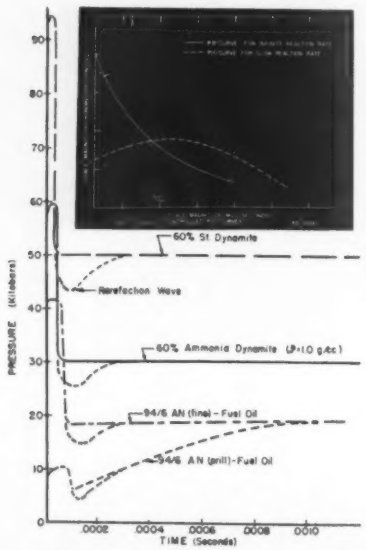
BIT proposed by Inett (left), a coring-like percussion chisel, cut inherent over-grind at center of bit and raised drilling speed a third. Mission's down-the-hole percussion cross bit with center chisel (third from left) also cuts center over-grind, as do roller-cone bits (right). Inett's bit also has greater chipway space to minimize exit restrictions to flow, especially of large chips, and thus cuts regrind energy-loss. Large exit space is also gained in the eccentric pilot-reamer rotary drag bit (second from left, Wallram) used for large-hole burn-cut drifting in ironstone in Britain. Any pilot-reamer bit drills faster than a full-face cutting type. Oil Tool's coarse off-set cones (third from right) give big chips and thus fast drilling in soft rock; their notched-disk-like cones for hard rock (next right) have the effect of the cutters on Robbins' Borer (p 216). T-C button cones have even worked in taconite (right, Hughes).

Blasting Practice Posts New Gains

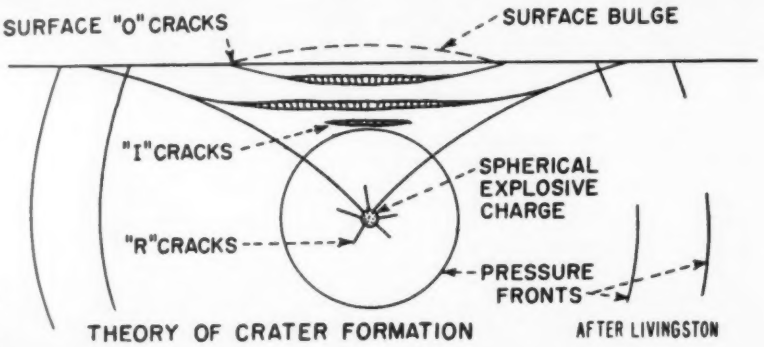
AMMONIUM NITRATE fertilizer-fuel oil blasting agents—low-cost, very-safe—continue to be the hottest topic in blasting—not only on surface but underground too (see next page). Furthermore, its success has probably stimulated much of the renewed interest in blasting that is evident at so many mines.

Knowledge of the chemistry and thermodynamics of explosives, especially pressure-time curves (left, under perfect confinement), and the effects on rock (below) should result in more economical practice. The relationship between scabbing (see 1958 Guidebook), internal fracturing and collision of fragments and waves in causing breakage are presently under close study and may give even better answers to the problem of more effective blasting.

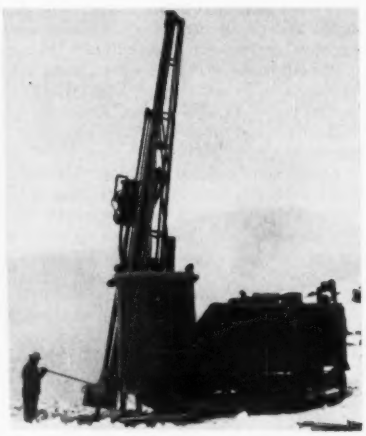
But perhaps the ultimate in low-costs will come from current research into a water and high-energy electric-spark system of blasting.



EXPLOSIVE P-T CURVES BY COOK

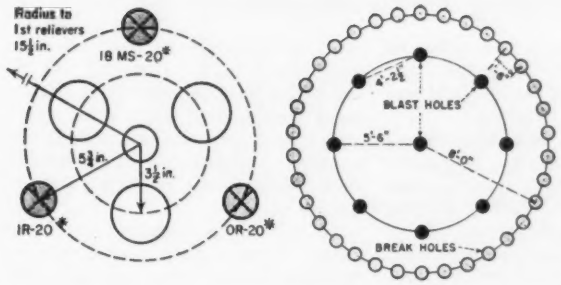


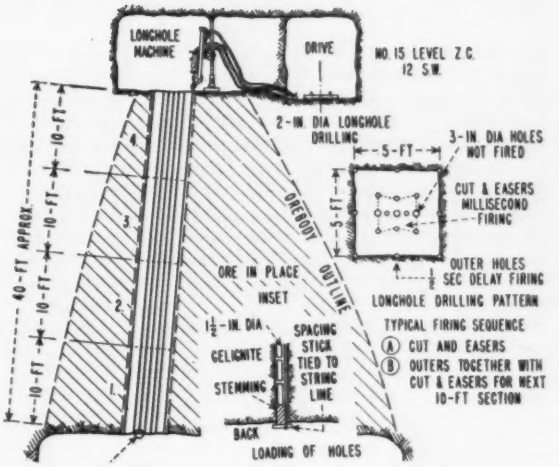
THEORY OF CRATER FORMATION AFTER LIVINGSTON



ON SURFACE, larger vertical holes have been promoted by the great success of fast rotary roller-cone drilling. Inclined holes, having advantages over true vertical, apparently are impractical with rotary rigs and have been limited to smaller percussion sizes. But now 7- and 9-in. down-the-hole percussion units are proving their capability for such work (right, I-R). Horizontal holes, even more advantageous, are being tackled by Peabody Coal with a large Joy rotary for 9-in. x 50-ft holes (above) and a newer Reich for 10-in. x 60-ft holes. Elevating carriages are available for such rigs.

Mechanized charging is growing. Pneumatic charging of loose powder is especially feasible. Kennecott's unit (below) and Atlas Powder's Jet Loader feed oil to AN prills as they are blown into the final length of pipe. Iron Ore Co. of Can. uses a V-bottom truck fitted with a screw feeder and air compressor to blow pre-mixed AN-oil through a hose. Gravity funnels with an oil spray near the outlet are common for vertical holes, e.g., Utah Construction's Bandut (below) with a bulk-AN tilt box. And IOC's AN-TNT-water slurry-explosive is readily pumped into wet holes.

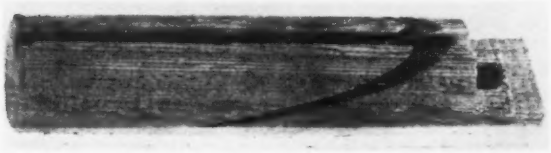


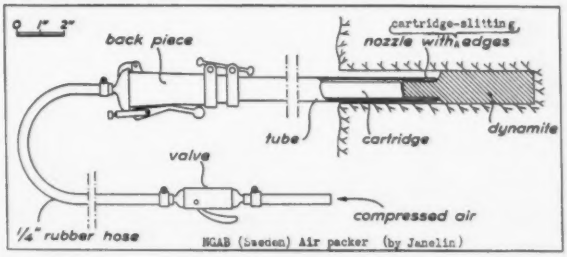


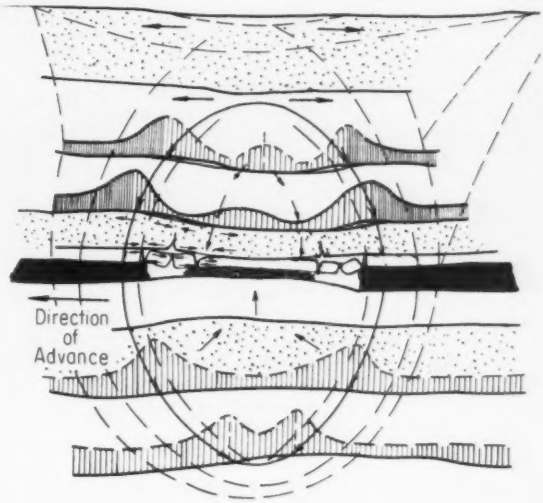
UNDERGROUND, St. Joe's 12-ft drift round features air-leg drilling with reamer bits and special timing ("0", 18-ms, "1" delays) of slow powder in the burn-cut (above left). For single 8-in. break-hole rounds, an I-R downhole drill was used on a water tunnel and an auger at White Pine. Pre-drilled raises (right, Zinc Corp., Australia) and shafts (above right, Hanna Coal, 8½-in. x 79-ft rotary holes, 10-ft lifts) are also examples of long, large-hole rounds.

Air chargers for stick powder are used in Sweden (below right). Similar units appear attractive for cartridged AN such as used at Eagle-Picher and IMM potash.

Stemming plugs are getting popular, e.g., wooden Trublast.





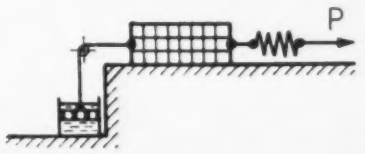


Ground Control Steadily Improves

IN PITS, the desire to minimize overburden removal with steeper slopes is widespread. Some consultants favor a soil mechanics approach which indicates that the overall slope should flatten with depth. They also point out the need to increase sliding resistance by drainage, cementation and pinning. Recently, at a tunnel-entrance cut in the Northwest, CF&I fencing and rockbolts were used to prevent slides (above left). Pit use is feasible.

Underground, research indicates that rock pressures and movements develop a circular pattern around an opening (above right, Awerschin). The concept of a zone of fractured ground around openings is supported by much evidence. So is the idea of an arch-like cave above openings with an inward movement occurring only at the surface.

Investigators also conclude that mechanically, rock acts like a spring (elastic solid), a sliding block (fragments with inter-particle friction) and a pierced piston in a liquid (viscous fluid) (below, Salustowicz).



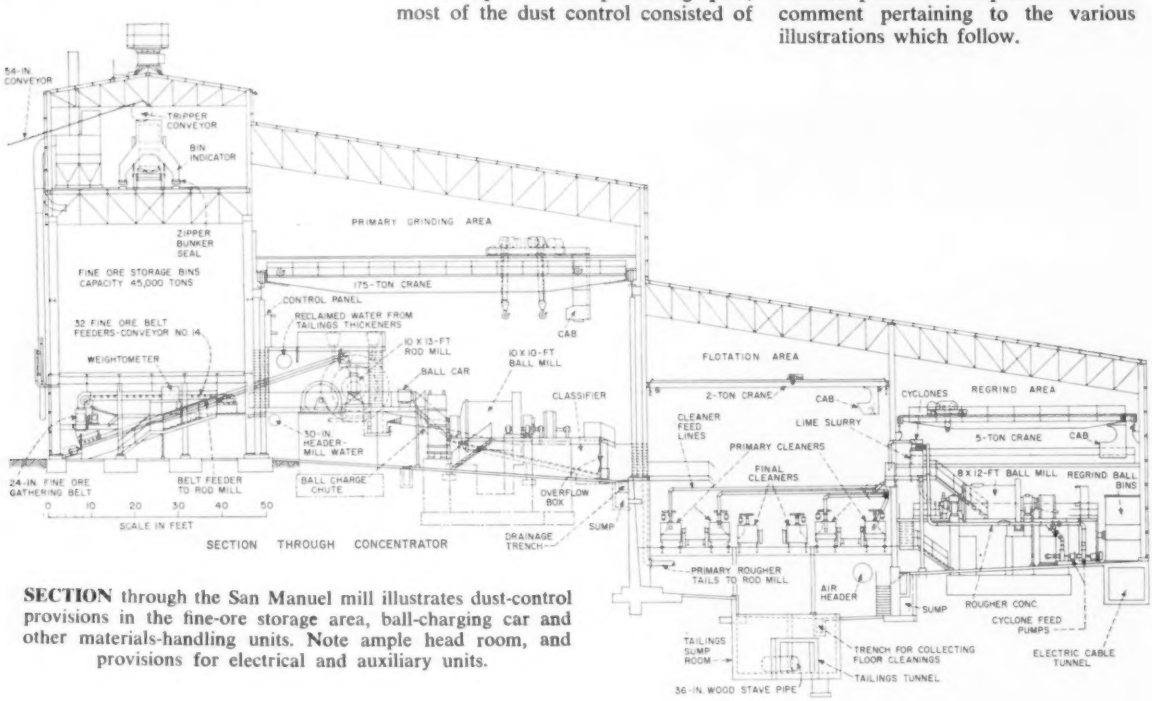
New Plants Feature Improved Working Environment

PLANT DESIGN ILLUSTRATIONS presented in this section were chosen from a number of modern projects presented in E&MJ during recent years. Plans, elevations and sections were selected to emphasize the efforts of some of the world's leading engineering and construction firms, plant design architects, and mining and metallurgical engineers to achieve low-cost processing of various metals and minerals.

Plants shown here do not illustrate full processing details or flowsheets. This information appears in the references cited in this section. However the illustrations do show how modern designers construct plants to accommodate processing equipment most effectively, and how power and auxiliary facilities are positioned. The principal differences between old and modern plants are as follows:

In the old plants. The designer was chiefly concerned with the equipment to be installed. Little attention was paid to the men who had to run the plant or to their comfort and safety. Automatic controls were nothing more than little gimmicks that the inventive millman and master mechanic devised. Plant workers spent most of their time lugging reagents, liners, ball charges and other supplies around by brute strength. Few plants had elevators. Lighting was generally gloomy and inadequate. Although dust-control equipment was installed in some of the most prolific dust-producing spots, most of the dust control consisted of sweepers pushing the dust from one part of the plant to another. As the old plants grew, more and more equipment was jammed into a given space. Air conditioning was unheard of, and electrical equipment often operated in dust-laden areas of high ambient temperature.

In the modern plant. Comfort and safety of the man is considered just as important as the installation of equipment. Fluorescent lighting or soft-green translucent corrugated panels provide adequate illumination. Materials handling equipment and elevators are provided where needed. Electrical equipment is operated in air conditioned dust-free control centers. Other features incorporated in modern plants are emphasized in the comment pertaining to the various illustrations which follow.



SECTION through the San Manuel mill illustrates dust-control provisions in the fine-ore storage area, ball-charging car and other materials-handling units. Note ample head room, and provisions for electrical and auxiliary units.

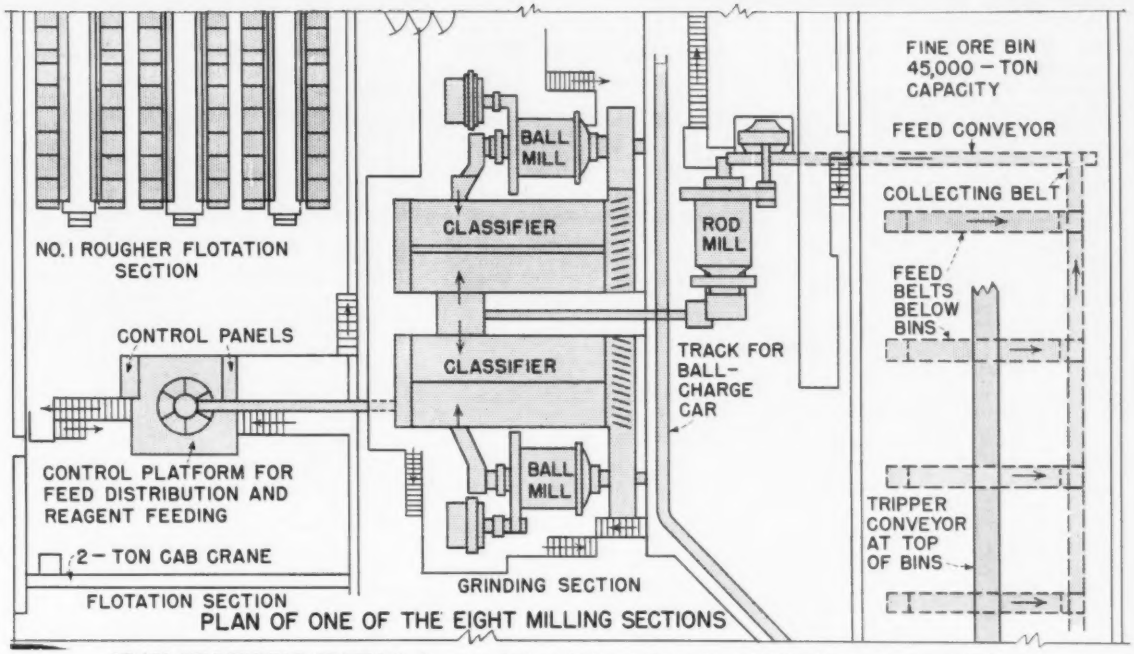
SAN MANUEL COPPER CORP.'s recently completed 30,000-ton concentrator consists of eight 4,000-ton mill sections consisting of one rod mill, two ball mills and four 120-cell rougher flotation sections which feed four regrind sections shown at right in the mill section illustrated above. Plan of a typical mill section is shown at right. Interior of the plant is clean and uncluttered because the designers have provided ample room for wiring, piping, launders and belts, and conduits for the flow of liquids and solutions in process. A band of plastic panels below roof line admits a soft green light.

Two large mill substations are pressurized with four 1,000-cfm 1.5-psi centrifugal blowers to lower operating temperatures of electrical equipment and keep out dust. Adequate seals and dust control units, chiefly of the roto-clone type, have been installed close to sources of dust generation.

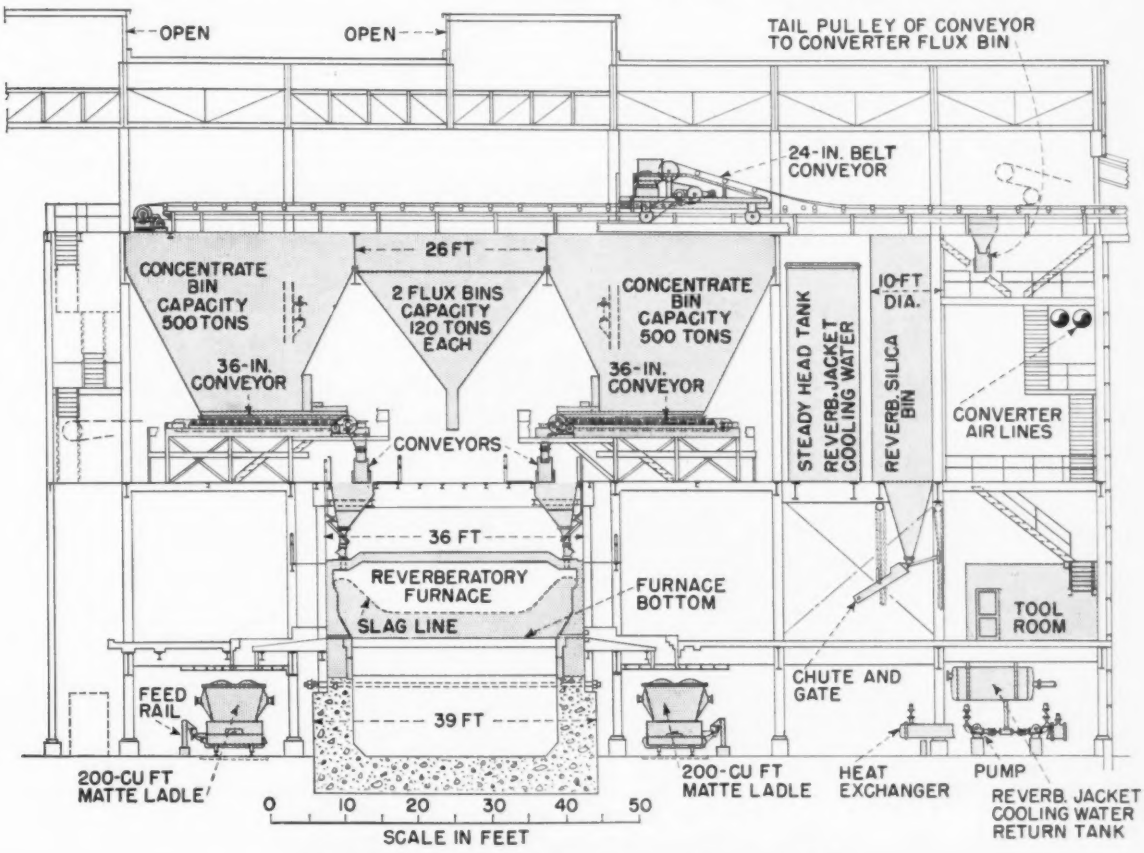
Conveniently spotted push-button control panels at strategic locations in full view of equipment under control provide prompt, sensitive and accurate regulation of feeding and operating units.

The section at right, through the reverberatory furnace, illustrates the elaborate materials-handling equipment installed to feed concentrates, silica and other fluxes to the furnace. In this plant, combustion control, furnace draft control, boiler feed-water rate and level, and automatic soot-blowing units are operated automatically from one centrally located control panel. Electric cars move the 200-cu ft matte ladles on either side of the furnace. The reverberatory is of the suspended-arch type.

Reference: "San Manuel — America's Newest Large Copper Producer" E&MJ, April 1956, pp 75-100.

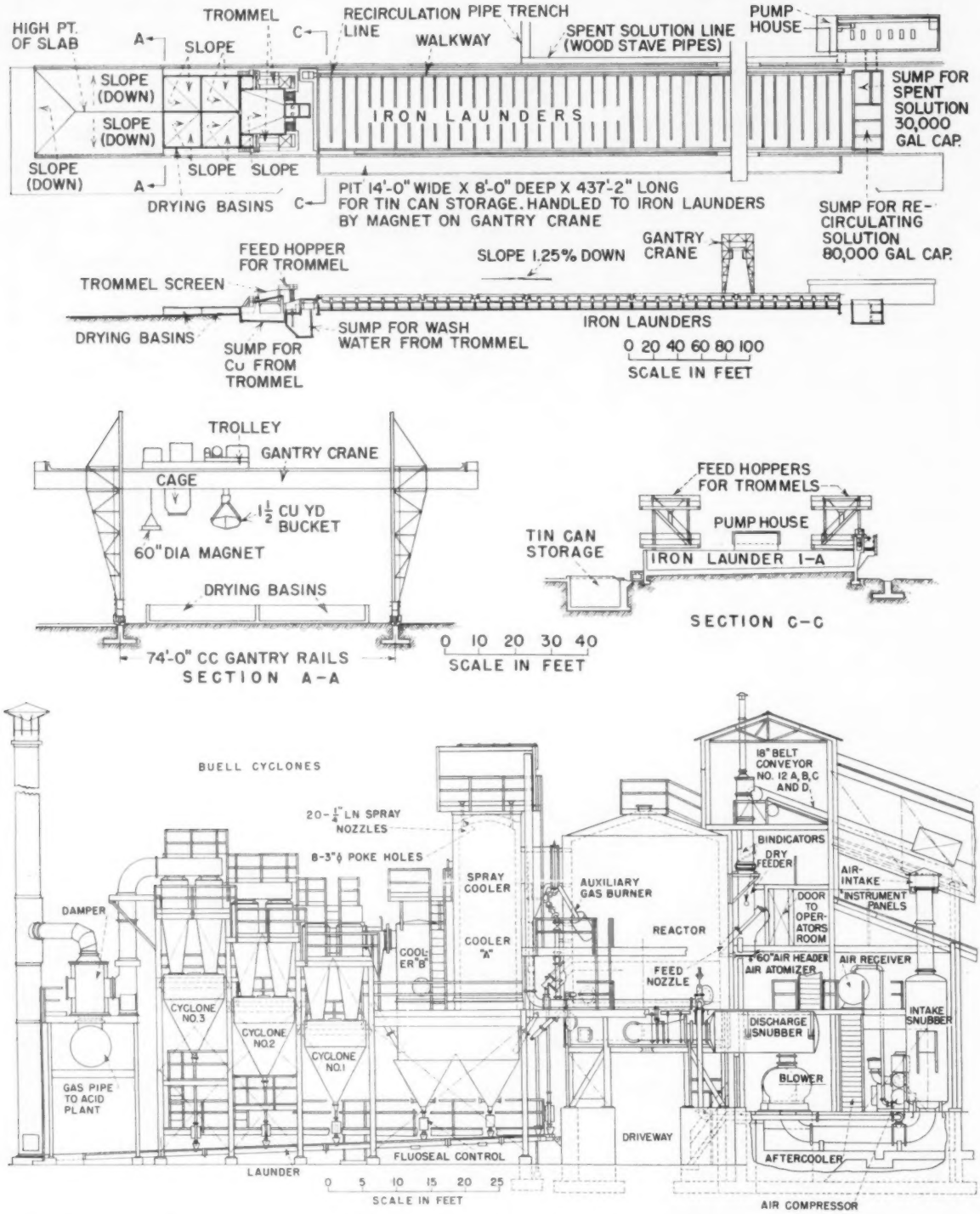


PLAN OF MILLING SECTION shows central control pulpit for feed distribution and reagent feeding.



SECTION THROUGH REVERBERATORY FURNACE

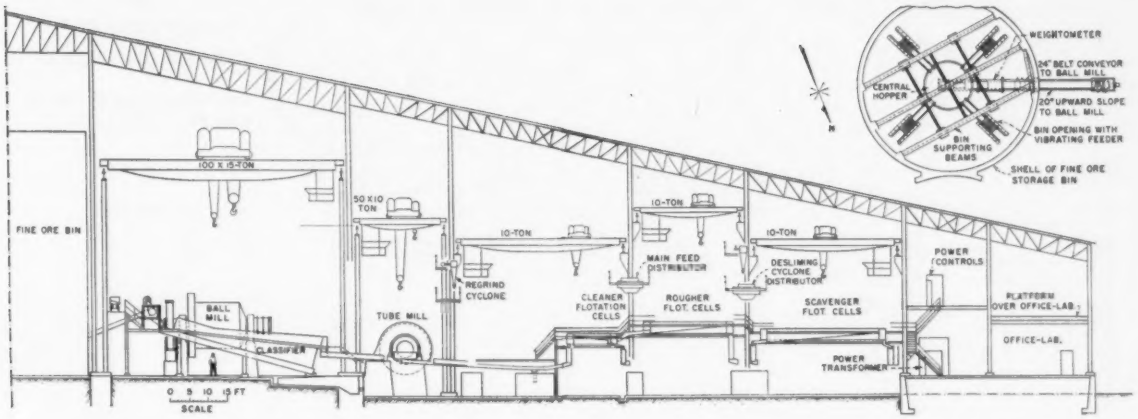
SUSPENDED-ARCH reverberatory furnace at San Manuel is designed to facilitate easy feeding and tapping.



Yerington Project

ANACONDA's modern FluoSolids plant for the production of sulphuric acid from sulphur, and leaching plant at the Yerington operations, Weed Heights, Nev., are shown above. The FluoSolids plant incorporates some of the finest automatic control equipment available. Operators say that they can maintain prompt and extremely sensitive control over the process through the instrumentation and control devices installed in a centralized control room.

Plan and sections through the leaching plant are shown above. Reference: E&MJ, August 1954.



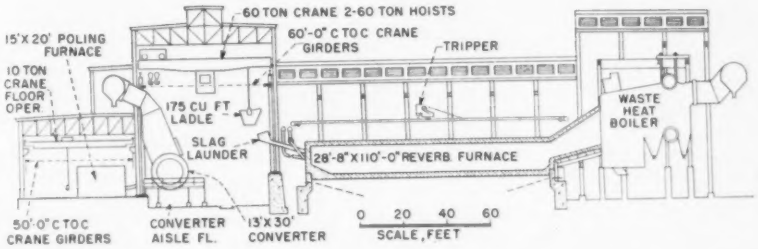
SECTION THROUGH MILL shows relative size of 13-ft ball mills, position of cyclones and electrical control equipment. Details of feeding equipment in 10-story fine-ore building appear in upper right.

White Pine Copper

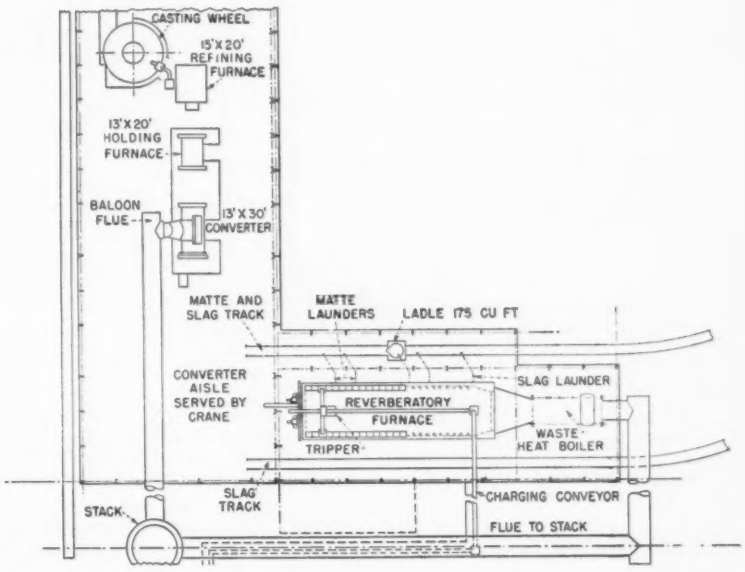
PLANT FACILITIES of the White Pine Copper Co. in northern Michigan which came into production in 1954 include a concentrator, copper smelter and power plant. The section through the mill above shows one of eight parallel primary grinding sections. Mills are flanked by twin spiral classifiers. The eight ball mills feed three secondary tube mills which provide feed for the flotation section of the mill. Design of the fine ore storage bins is unique. The six circular bins hold 3,000 tons each. Soil pressure under the bins was about 4,500 lb per sq ft. Because of the glacial till and clay footing, a cellular concrete mat was designed to spread the weight of the bins. Otherwise a solid concrete mat, 6 ft thick would have been required. Note also in the mill drawing above how ore is fed from four openings in the bottoms of the fine-ore storage bins to a central hopper by vibrating feeder. Ore is carried upward to the ball mills on a 20-deg belt conveyor.

Flotation concentrate consists chiefly of copper sulphide and copper silicates. Thus it is necessary to add lime and pyrite to make a satisfactory feed for the smelter. Lime and pyrites are fed automatically to the belt conveying the concentrate. The concentrate-flux feed is mixed thoroughly in pug mills, and conveyed to two storage silos, each of which has the capacity to supply a single charging cycle for the reverb. An additional building permits bedding, blending and storage of smelter feed.

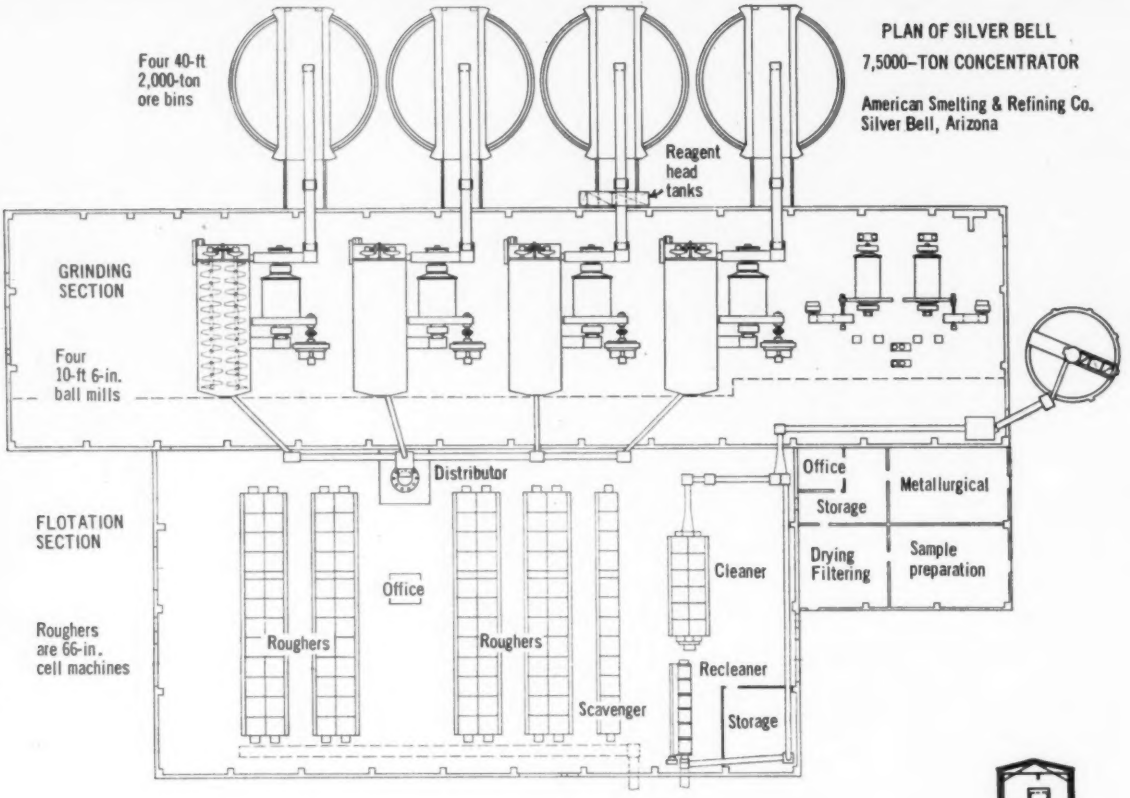
Plan and section of the White Pine copper smelter are shown at right. The plant was initially designed to produce about 75-million lb of copper per year. Matte is tapped from the middle of the suspended arch reverberatory furnace and led out into a ladle carried by a self-driven electric car operated by push buttons. Reference: Initial design features published in E&MJ, January 1953.

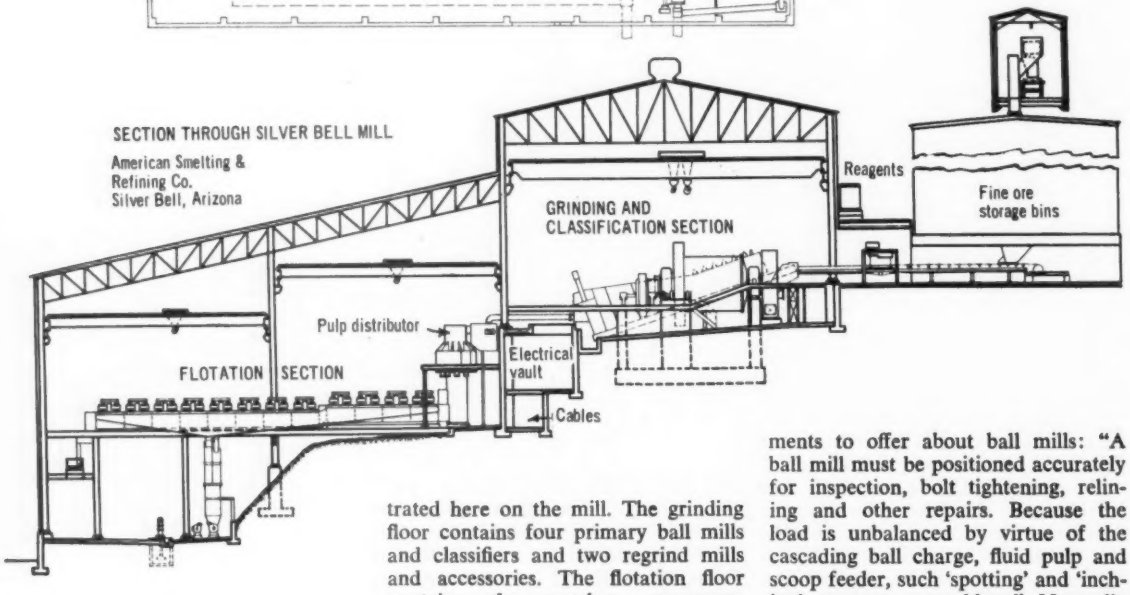


SMELTER SECTION shows position of suspended-arch reverberatory furnace with respect to converter, poling furnace and waste-heat boiler installation.



SMELTER PLAN shows row of square hoppers over reverberatory furnace through which feed enters from tripper in belt from flux mixing plant.





Asarco's Silver Bell

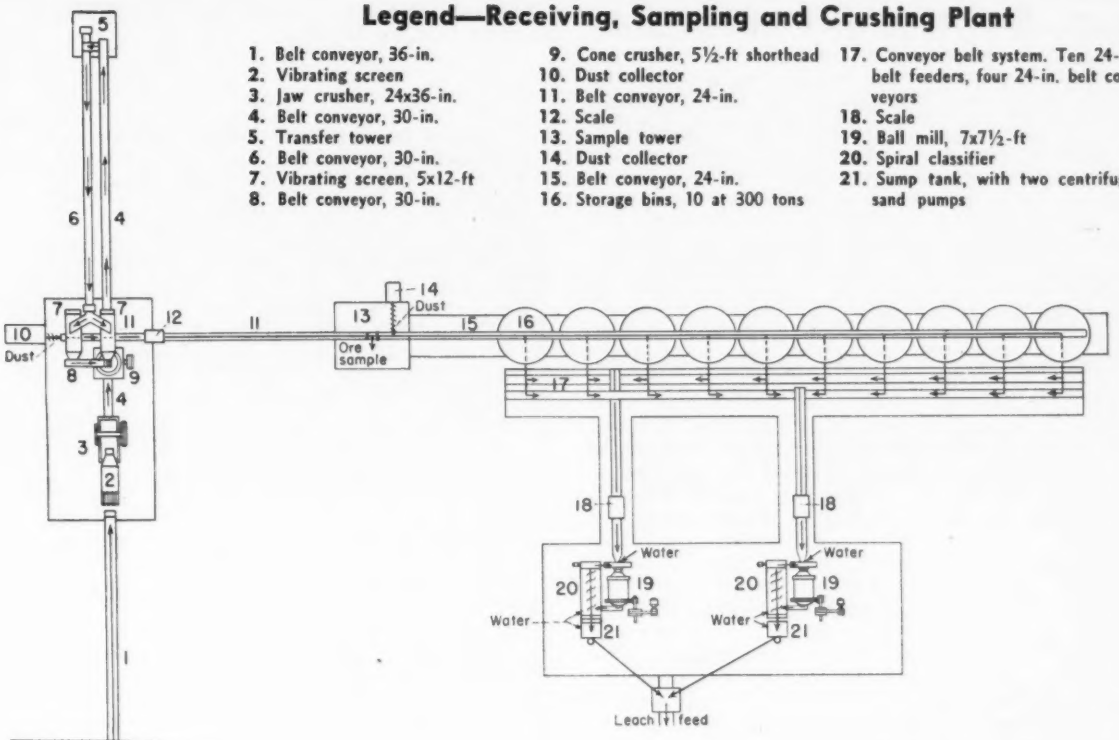
ANOTHER MODEL OF MODERN DESIGN is Asarco's Silver Bell project in Arizona. The company's 7500-ton concentrator went on stream in April 1954. Although many unique features are in evidence in the crushing plant and elsewhere, attention is concentrated here on the mill. The grinding floor contains four primary ball mills and classifiers and two regrind mills and accessories. The flotation floor contains the rougher, scavenger, cleaner and recleaner flotation machines. Both floors have space for additional units and repairs. The emphasis on provisions for repair and expansion is characteristic of virtually every modern plant.

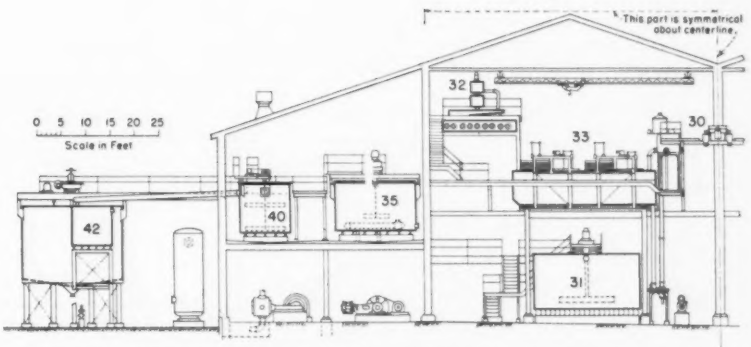
In a paper presented before the AIME in 1956, Norman Weiss, milling engineer, and W. H. Tuttle, assistant metallurgist, had these comments to offer about ball mills: "A ball mill must be positioned accurately for inspection, bolt tightening, relining and other repairs. Because the load is unbalanced by virtue of the cascading ball charge, fluid pulp and scoop feeder, such 'spotting' and 'inching' presents a problem." Normally such "inching" would require the installation of a 150-250-ton crane. But by an ingenious revision of electrical circuits this objective was accomplished at Silver Bell without large cranes.

References: "Silver Bell Concentrator" Norman Weiss, and W. H. Tuttle. AIME regional session, March 1956. Also E&MJ, July 1954.

Legend—Receiving, Sampling and Crushing Plant

1. Belt conveyor, 36-in.
2. Vibrating screen
3. Jaw crusher, 24x36-in.
4. Belt conveyor, 30-in.
5. Transfer tower
6. Belt conveyor, 30-in.
7. Vibrating screen, 5x12-ft
8. Belt conveyor, 30-in.
9. Cone crusher, 5½-ft shorthead
10. Dust collector
11. Belt conveyor, 24-in.
12. Scale
13. Sample tower
14. Dust collector
15. Belt conveyor, 24-in.
16. Storage bins, 10 at 300 tons
17. Conveyor belt system. Ten 24-in. belt feeders, four 24-in. belt conveyors
18. Scale
19. Ball mill, 7x7½-ft
20. Spiral classifier
21. Sump tank, with two centrifugal sand pumps





SECTION THROUGH RIP PLANT shows pregnant pulp storage (31), flow distributor (32), RIP tanks and screen baskets, vibrating screens (30), regeneration tanks (35), precipitation tanks (40), and thickener overflow tank (42).

Uranium Reduction

TO KEEP the Uranium Reduction Co. plant at Moab, Utah, running at capacity, trucks have to be weighed in or out every 6 min, 24 hr per day. The stockpiling retrieval and sampling of ore at custom mills such as this require special attention to the design of facilities performing these functions. In addition, the variable nature of the ores requires blending to give fairly constant feed. Thus, lots from each producer must be accumulated in a separate stockpile to provide more economically managed quantities. Incoming trucks dump ore at designated sections on the 200-ft dia, 3,000-ton capacity slabs shown above. Radial walls partition sections. Later, a loader or bulldozer blend-feeds ore to a 12-in. grizzly at the center of the pad. Below the grizzly, an 80-ton steel bin supplies ore to a 48-in. belt feeder which loads the 36-in. belt conveyor terminating in the crushing plant.

Further details of the crushing, sampling, fine-ore storage and retrieval plant and grinding and classification section are shown above.

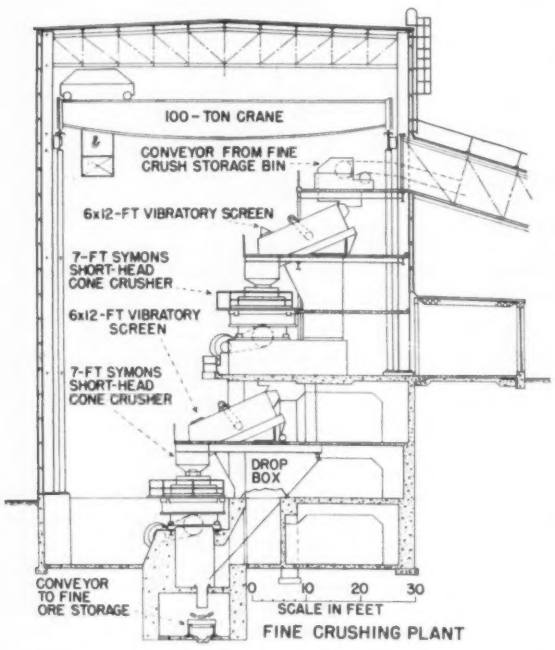
A section through the initial resin-in-pulp plant (RIP) illustrates the orderly arrangement of equipment and auxiliary units in modern plants. Shown above are the pregnant-pulp storage tank and the stainless steel (32) flow distributor unit which feeds stainless steel RIP tanks containing oscillating stainless steel screened baskets in which resin beads adsorb negatively-charged uranium bearing ions from the pulp (33). Reference: "Moab Mill Starts Making U_3O_8 Cake," E&MJ, Jan. 1957 by Theodore Izzo, Lew Painter, and Roman Chelminski.

Reserve's Taconite Concentrator

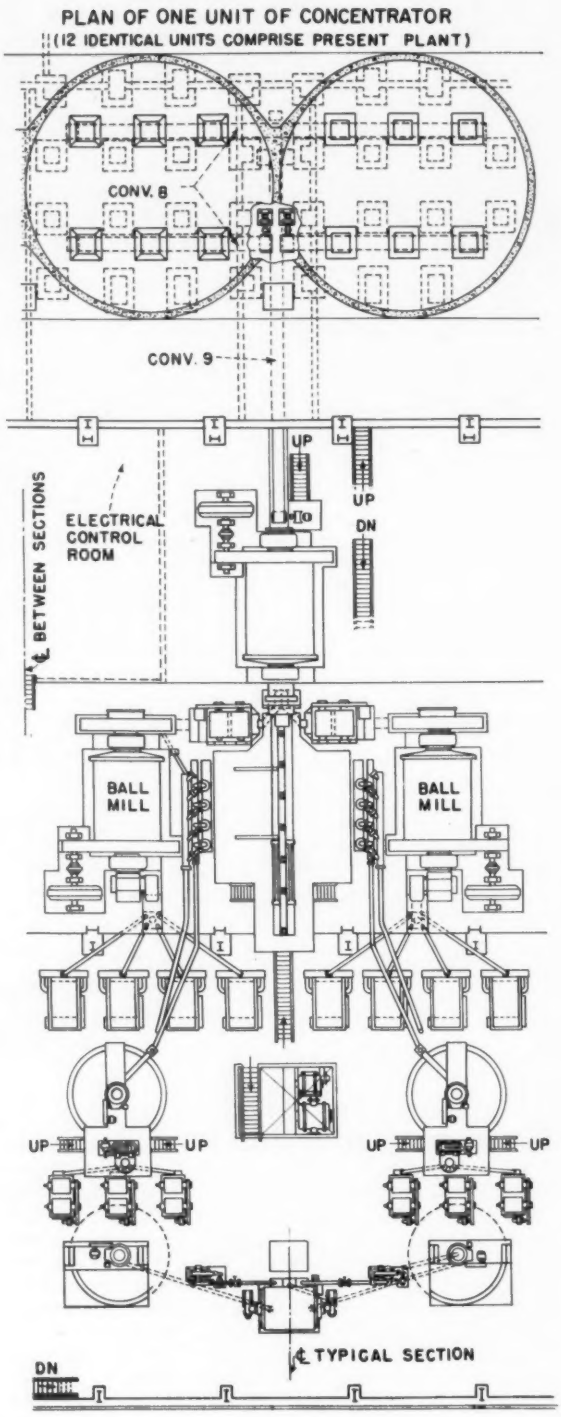
Reference: "Reserve's New Taconite Project," E&MJ, December 1956, pp 75-102.

AMPLE PROVISIONS have been made in the design of Reserve Mining Co.'s new taconite plant at Silver Bay, Minn. for expansion from an initial capacity of 3¾-million tons of pellets per year to 10-million tons if required. Before designing the final plant shown here, management insisted that a full size string of equipment (not a pilot plant in the usual sense of the word) be pretested to develop the ideal combination of equipment and to prove its effectiveness in a prolonged test run. In these test runs 3,000 tons of ore were processed per day. Changes were made in grinding media, pulp densities to determine optimum performance. Classifiers were run in parallel circuit with cyclones to compare performance. On the basis of these tests, the ideal string of equipment shown at right was selected. In the initial plant, 12 of these sections were installed in parallel. One result of the tests saved the company substantial sums in building costs. The selection of cyclones instead of classifiers enabled the company to narrow the width of the 1,307 ft long concentrator, and thereby save the cost of many square feet of housing for equipment.

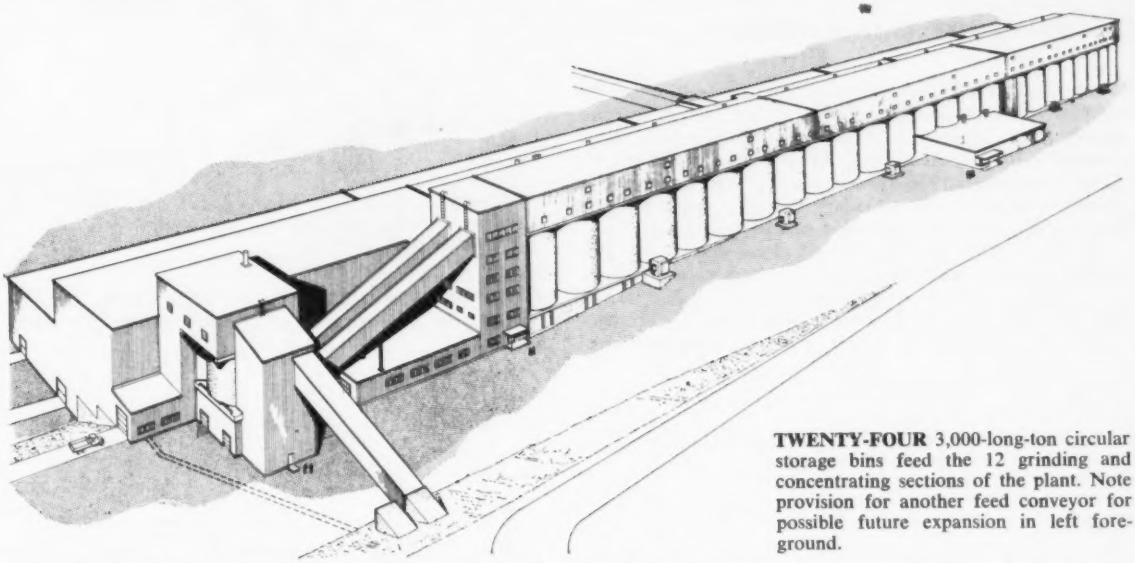
Although initial capacity of the plant was 3¾-million tons of pellets per year, Robert J. Linney, executive vice president of Reserve, reported at the February AIME meeting in San Francisco recently that good basic engineering and plant design had enabled production to increase to about 5-million tons of pellets per year within a three-year initial operating period. "One big advantage," he said, "was the 'elbow room' the designers allowed. They didn't cram the machinery in with a shoe horn. The planned extra space for unanticipated situations has paid off handsomely in the three short years of operation. To have provided tight design would have been a great handicap."



SECONDARY CRUSHING PLANT contains totally enclosed screens, crushers and transfer equipment to control dust.



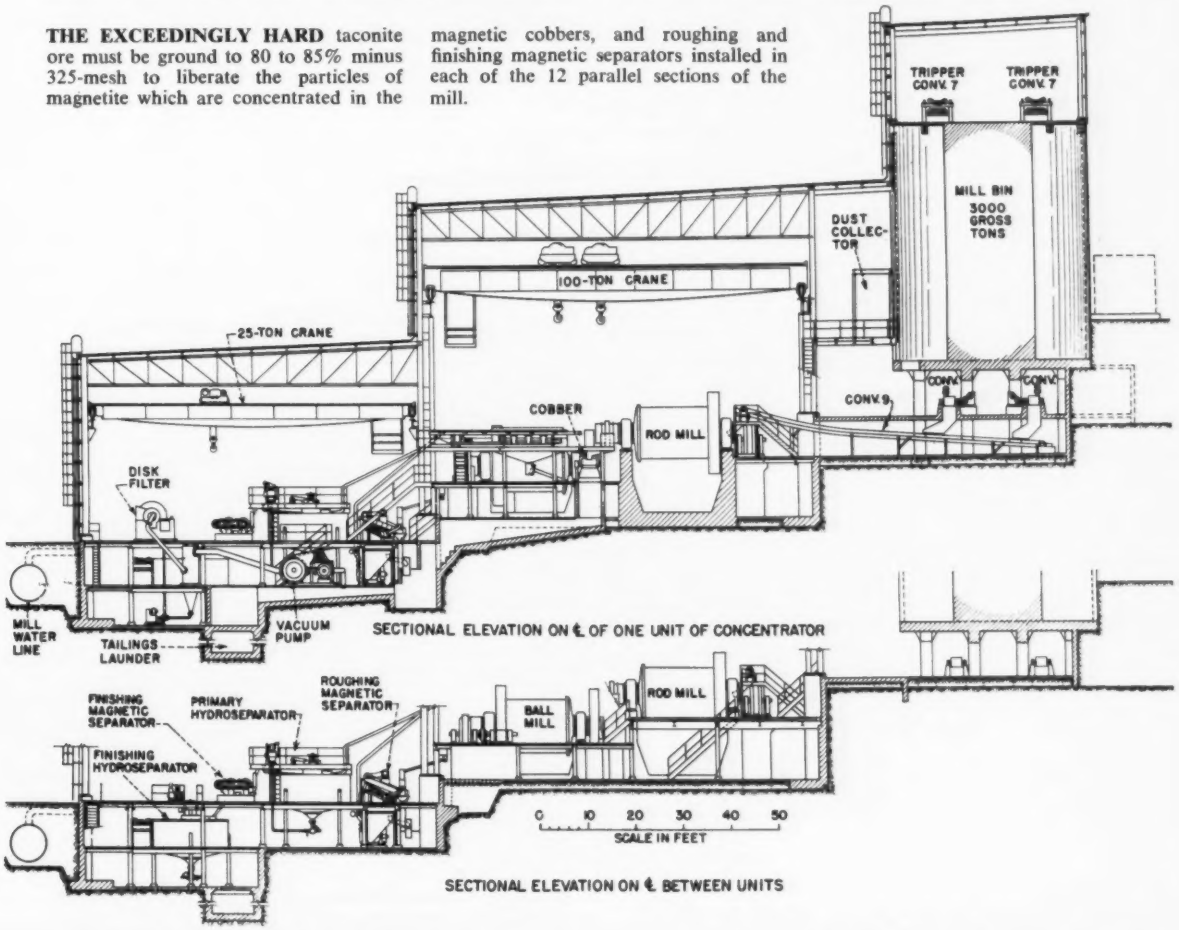
TYPICAL SECTION showing grinding units, magnetic separators, and filters. Present plant has 12 units in parallel.



TWENTY-FOUR 3,000-long-ton circular storage bins feed the 12 grinding and concentrating sections of the plant. Note provision for another feed conveyor for possible future expansion in left foreground.

EXTERIOR of the 1,307-ft long concentrator housing the twelve parallel grinding and concentrating equipment shown in plan and elevation on these pages. If required, a similar wing will be added on to the left of this building.

THE EXCEEDINGLY HARD taconite ore must be ground to 80 to 85% minus 325-mesh to liberate the particles of magnetite which are concentrated in the magnetic cobbers, and roughing and finishing magnetic separators installed in each of the 12 parallel sections of the mill.

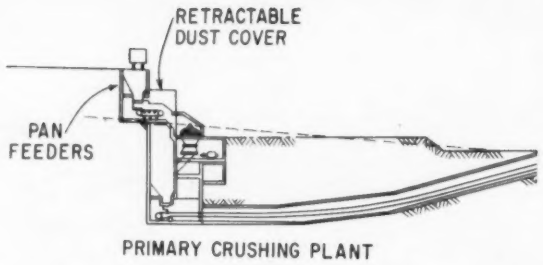


AUXILIARY EQUIPMENT received the same attention as major units in this plant. For instance, the hydraulic system must be adequate to supply and distribute roughly 40 tons of water (10,000 gal) for each ton of concentrate processed.

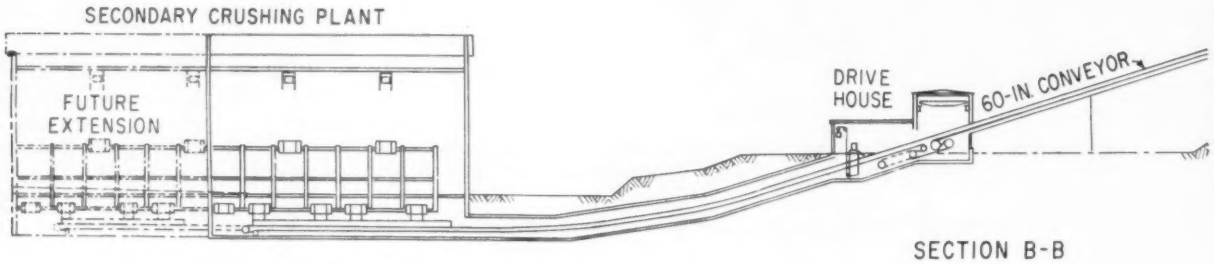
El Salvador Concentrator

ANACONDA's new El Salvador concentrator went on stream in April. Capacity is 33,000 tons per day. Design features shown here appeared in a more complete article "How Anaconda-Jurden Associates Achieve Modern Design", E&MJ November 1958. Provisions for future expansion, as shown here for the secondary crushing plant and fine-ore storage area, are typical of many large plants.

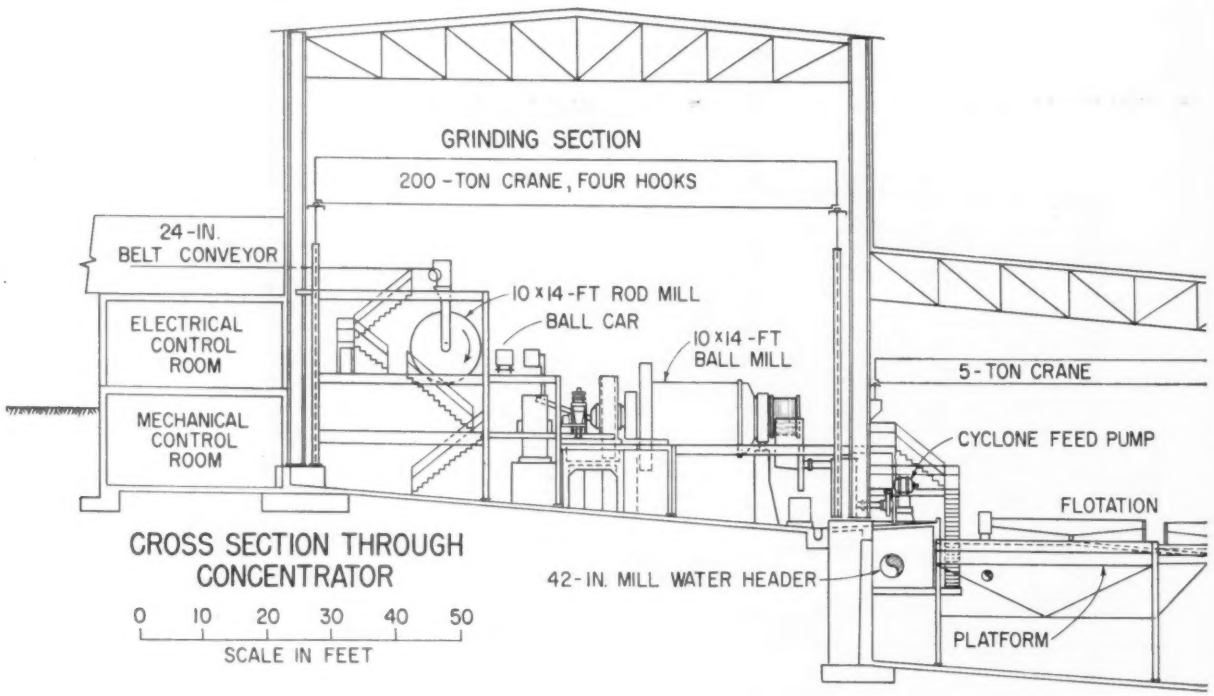
Design of this project involved three steps: (1) Development of a metallurgical flowsheet by metallurgists, (2) expansion of the metallurgical flowsheet into a mechanical flowsheet as illustrated here, and (3) arrangement of the various buildings, storage areas and conveyors into an orderly right-angle arrangement to effect economy in construction and efficiency in processing the ore.



PRIMARY CRUSHING PLANT

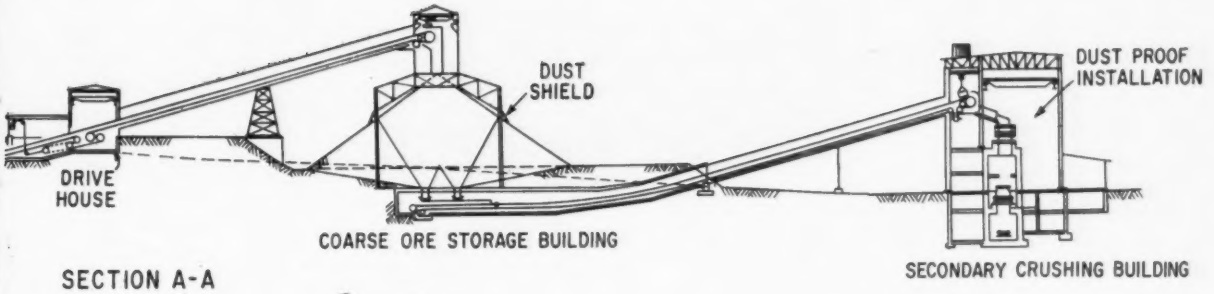


SECTION B-B

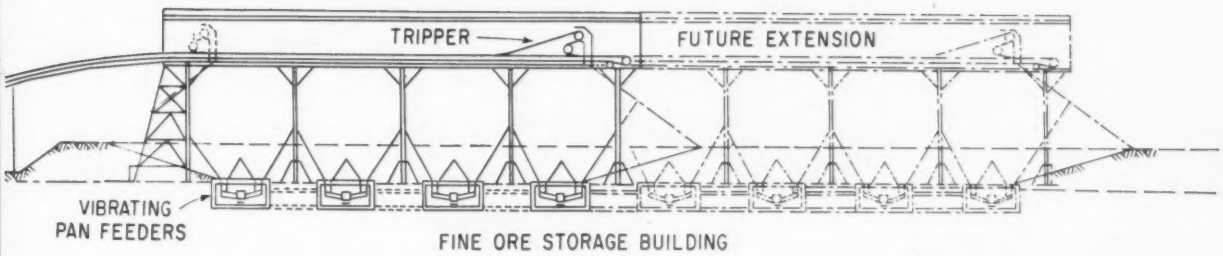


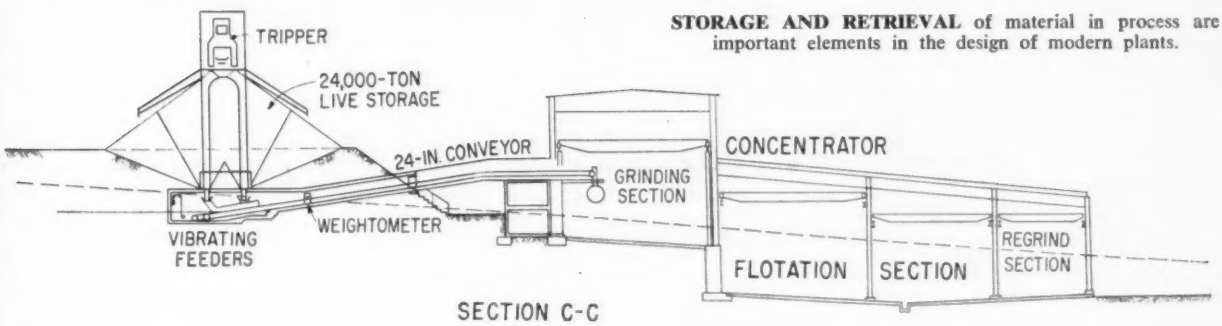
CROSS SECTION THROUGH CONCENTRATOR

CROSS-SECTION through the concentrator illustrates provisions for electrical and mechanical controls in specially designed dust-free, temperature-controlled rooms. Ample overhead crane capacity is provided to pick up whole equipment units such as ball- or rod-mill shells and transfer them to a repair bay for relining or repair. Earthmoving equipment was used liberally to provide a plant terrain that would permit an ideal flowthrough of pulp from the grinding section to the regrind plant at right.



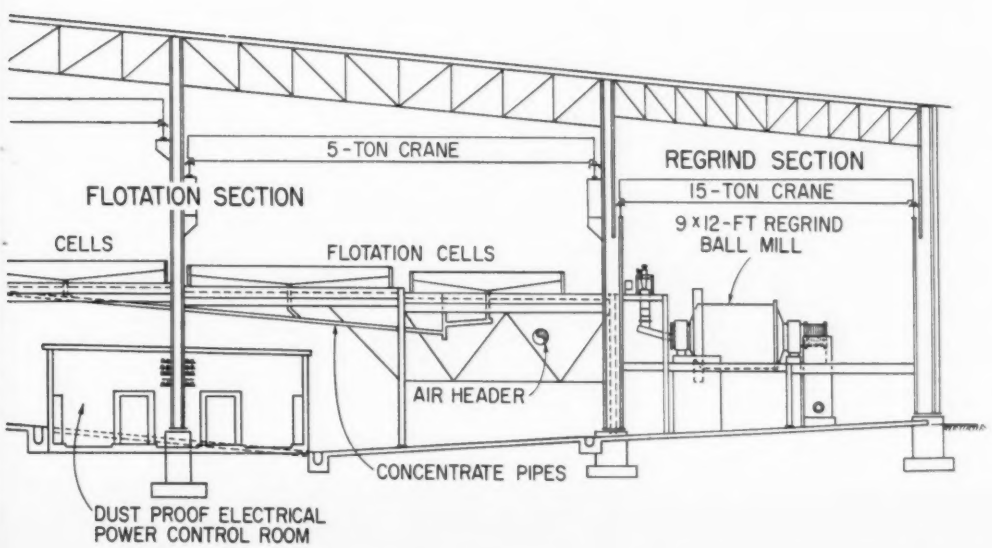
SECTION A-A

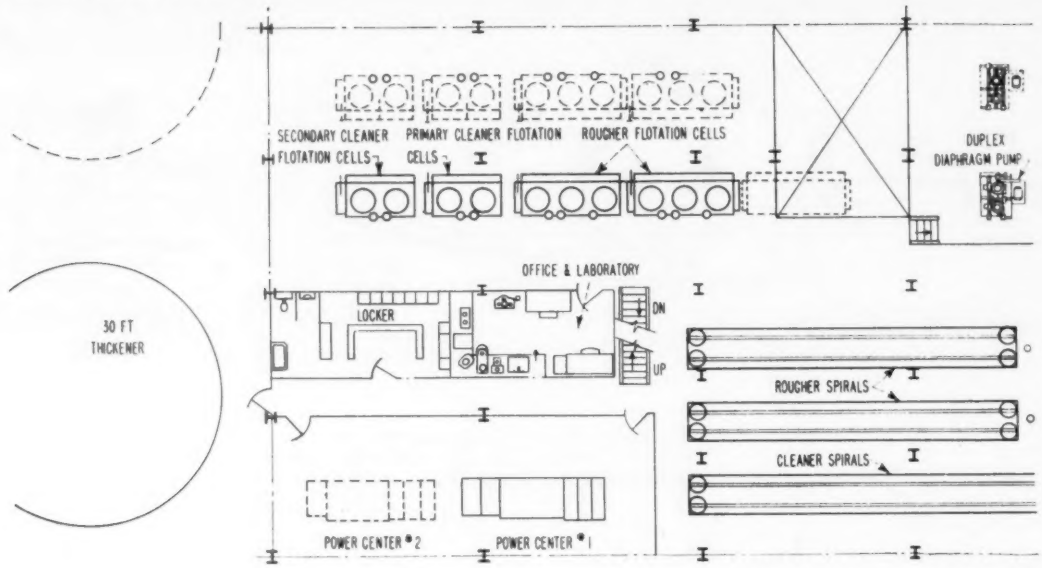




SECTION C-C

STORAGE AND RETRIEVAL of material in process are important elements in the design of modern plants.



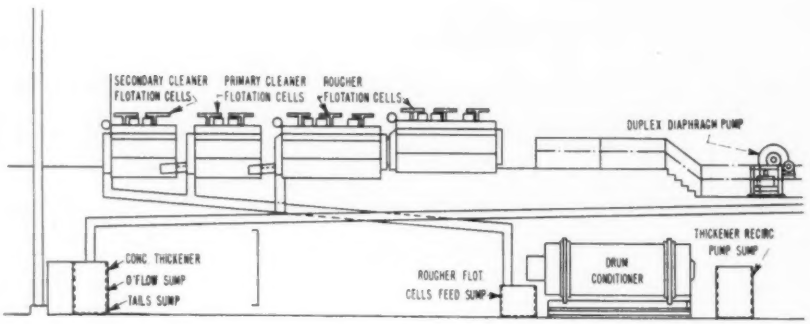


FLOOR

Hill Annex Plant

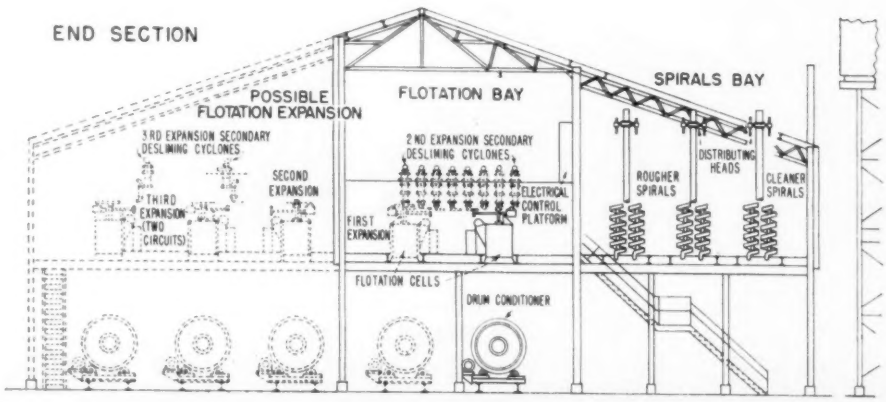
JONES & LAUGHLIN Steel Corp.'s Hill Annex tailings reclamation plant at Calumet, Minn. is the first commercial application of froth flotation on the Mesabi Range. A spiral concentration section precedes the flotation. Flotation started in July 1957. Feed to the plant comes from an electric suction dredge operating on an adjacent wash tailings pond. The plant produces 100 long tons of 60% Fe concentrate per hr. This plant is unusual in that hydraulic transport is retained right to the shipping bin where a final dewatering classifier and filter mounted over the bin deliver the final product. No belt conveyors are used anywhere in the plant. Reference: "Flotation Starts in the Mesabi," by Richard W. Livingston, chief ore dressing engineer, Jones & Laughlin Steel Co., E&MJ, Jan. 1958, pp 90-93.

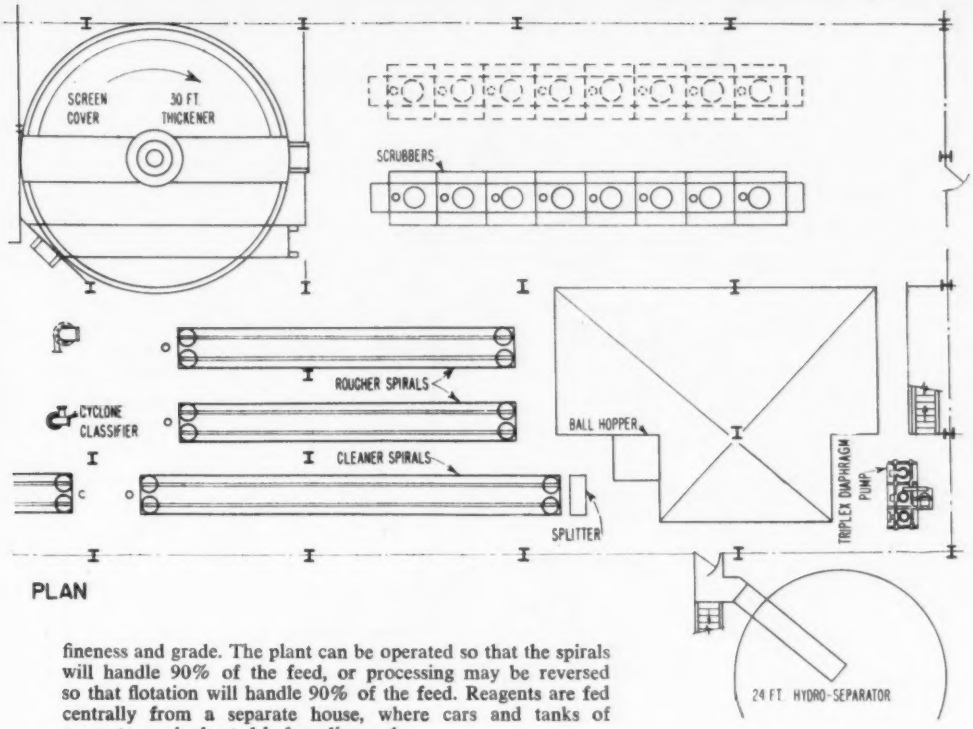
EQUIPMENT HAS BEEN ARRANGED with the idea of easy access and expansion as well as orderly flow of material in process. Dotted lines in the plan and section show provisions which have been made for expansion. The plant is versatile in design to handle feed which may change in



SECTION THROUGH

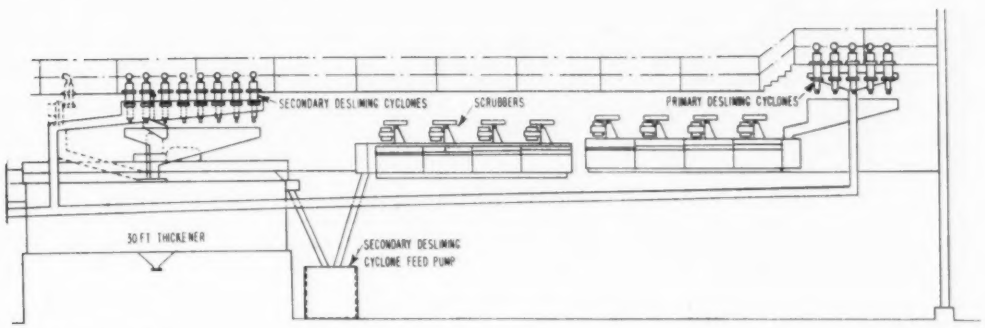
END SECTION at right shows reason for present unbalanced appearance of building — to allow for future expansion. All heavy machinery has been installed on the lower level, as well as the pumps. Upper levels of the plant are floored with grating. Process flow is toward the left of the plant in general. All material is transported hydraulically. No conveyor belts are installed in the plant. Final product is filtered and dropped into storage bins.





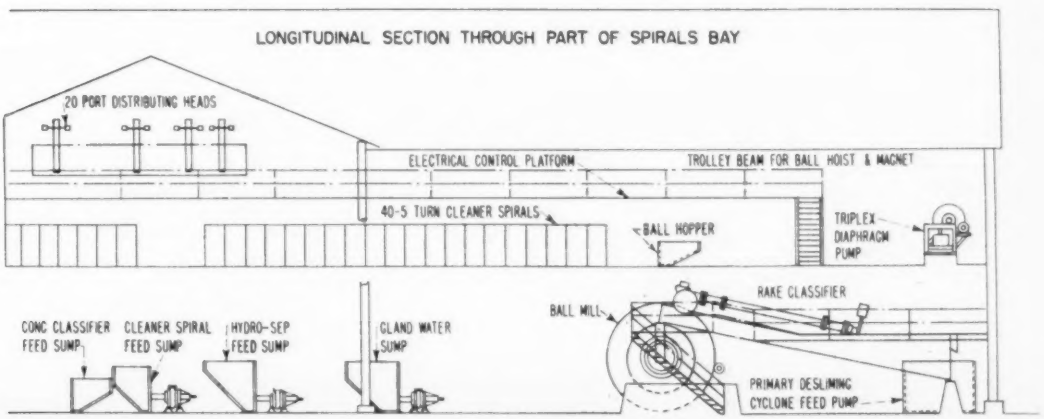
PLAN

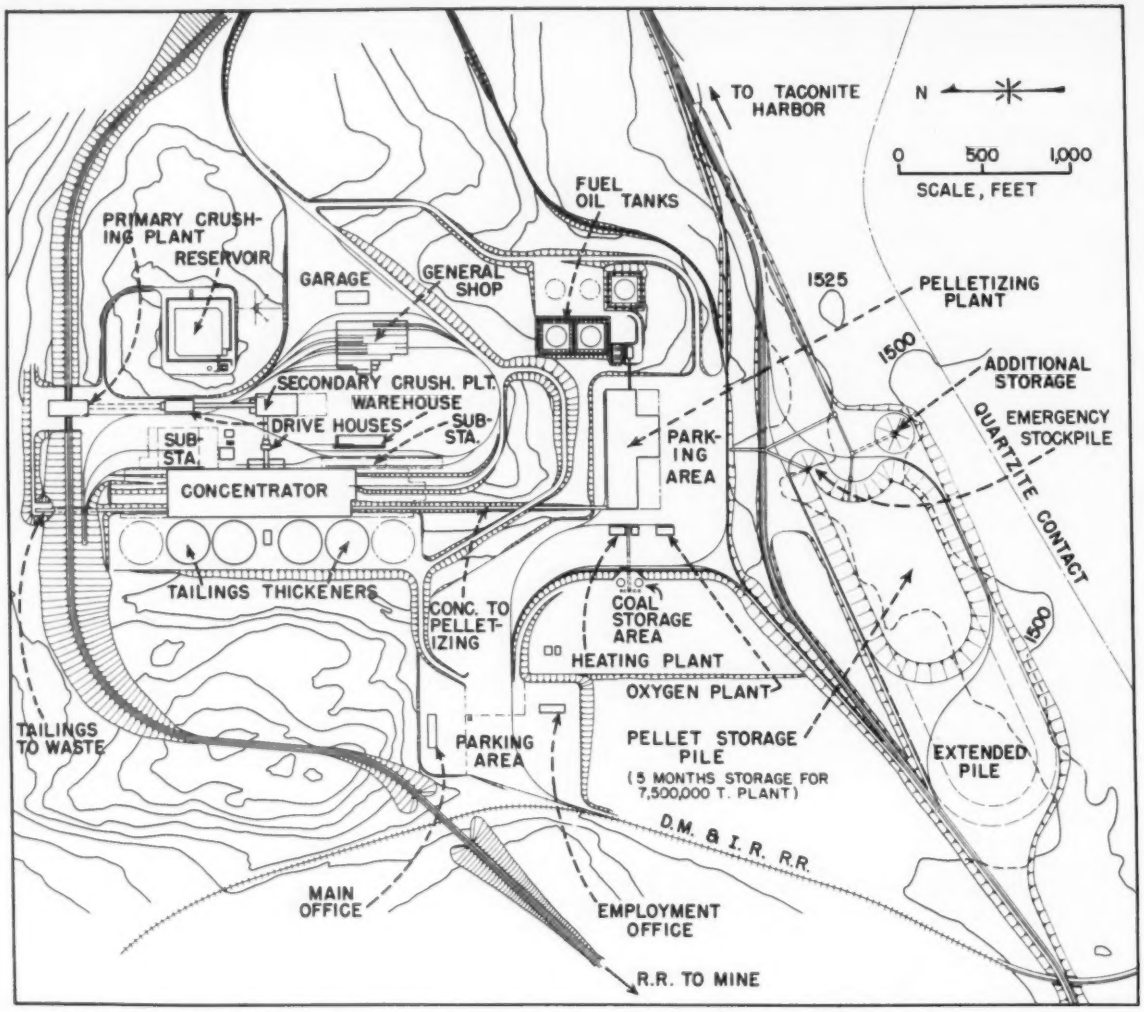
fineness and grade. The plant can be operated so that the spirals will handle 90% of the feed, or processing may be reversed so that flotation will handle 90% of the feed. Reagents are fed centrally from a separate house, where cars and tanks of reagents can be heated before dispersal.



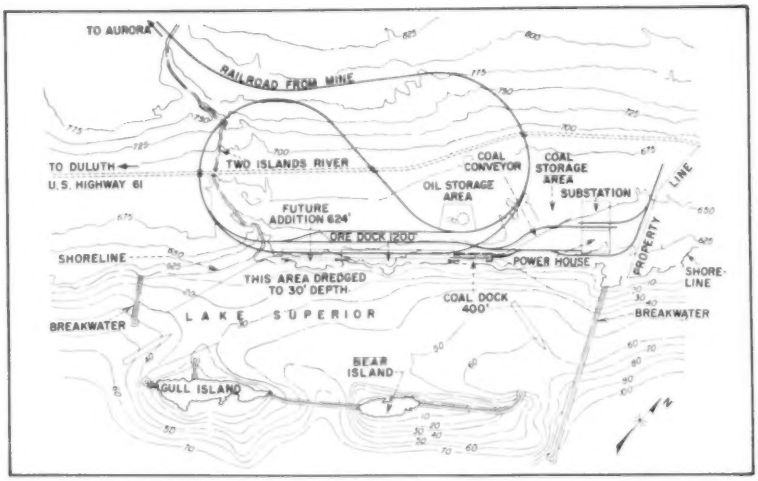
FLOTATION BAY

SCALE IN FEET (ALL DRAWINGS)





AN ORDERLY RIGHT-ANGLE arrangement of plant buildings and stockpiling, storage and conveying facilities, characteristic of modern plant design, is evident in the above crushing, concentrating and pelletizing units near Aurora.



TACONITE HARBOR, on Lake Superior, will permit ships to enter near Gull Island, load, and depart at right without turning around. Pellets will be loaded into over multiple retractible conveyor belts installed at the ore dock.

Progress at Erie

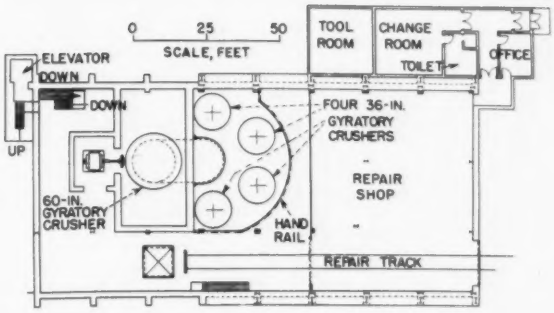
ERIE MINING CO. shipped 2,652,000 tons of pellets in 1958. Although the plant is not yet in full production of 7.5-million tons of pellets per year, it is expected that shipments for 1959 will total about 6-million tons. Present employment numbers about 2,300 which will increase to 3,000 when capacity is reached.

Facilities, other than those illustrated here include a power plant at Taconite Harbor. The steam-fed turbogenerator operates at 1,000 deg F, and 1,450-lb pressure. Power is generated at 138,000 v, and stepped down to 13,800 v for distribution at the plant and pit. Simplified flowsheet of the project appears in E&MJ, March 1955, p 73.

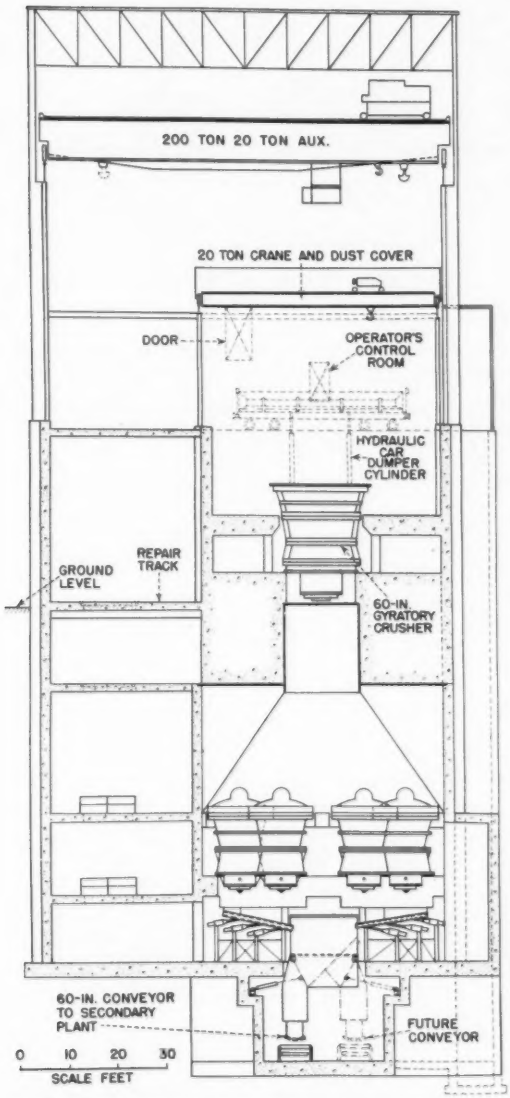
World's Largest Taconite Plant

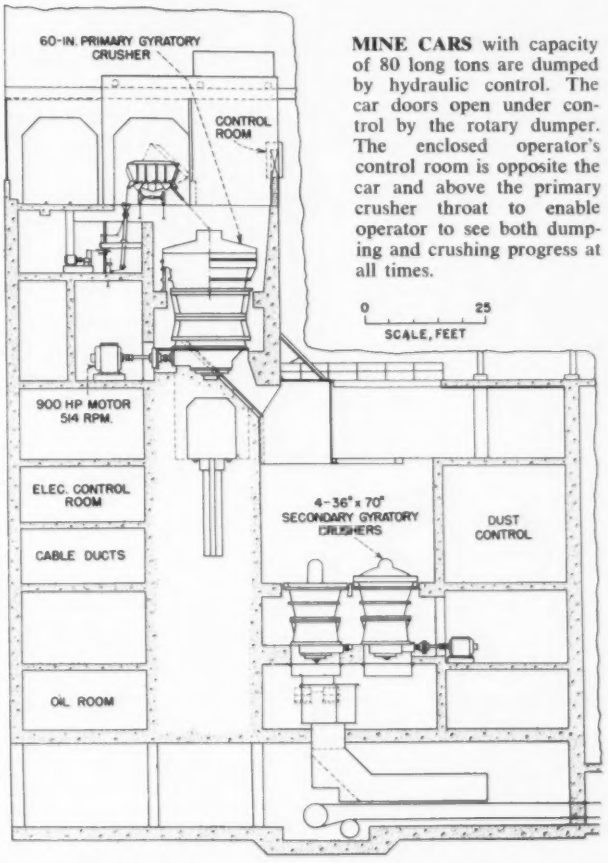
THE ERIE MINING CO.'s project to produce about 7.5-million tons of taconite pellets per year includes the mine, concentrator and concentrating plant near Aurora, Minn., and ore-shipping facilities and power plant at Taconite Harbor on Lake Superior. Capacity of the concentrator is about 63,000 long tons per day. The plant is the largest ever built as a unit.

Companies which participated in the design and development of the project are Pickands Mather & Co., Bethlehem Steel Corp., Youngstown Sheet and Tube Co., Interlake Iron Corp., and the Steel Co. of Canada, Ltd. Plant design was based on full-scale production experience of a development plant. Reference: "Teamwork On Taconite," by Robert H. Ramsey, E&MJ, March 1955, pp 72-93.



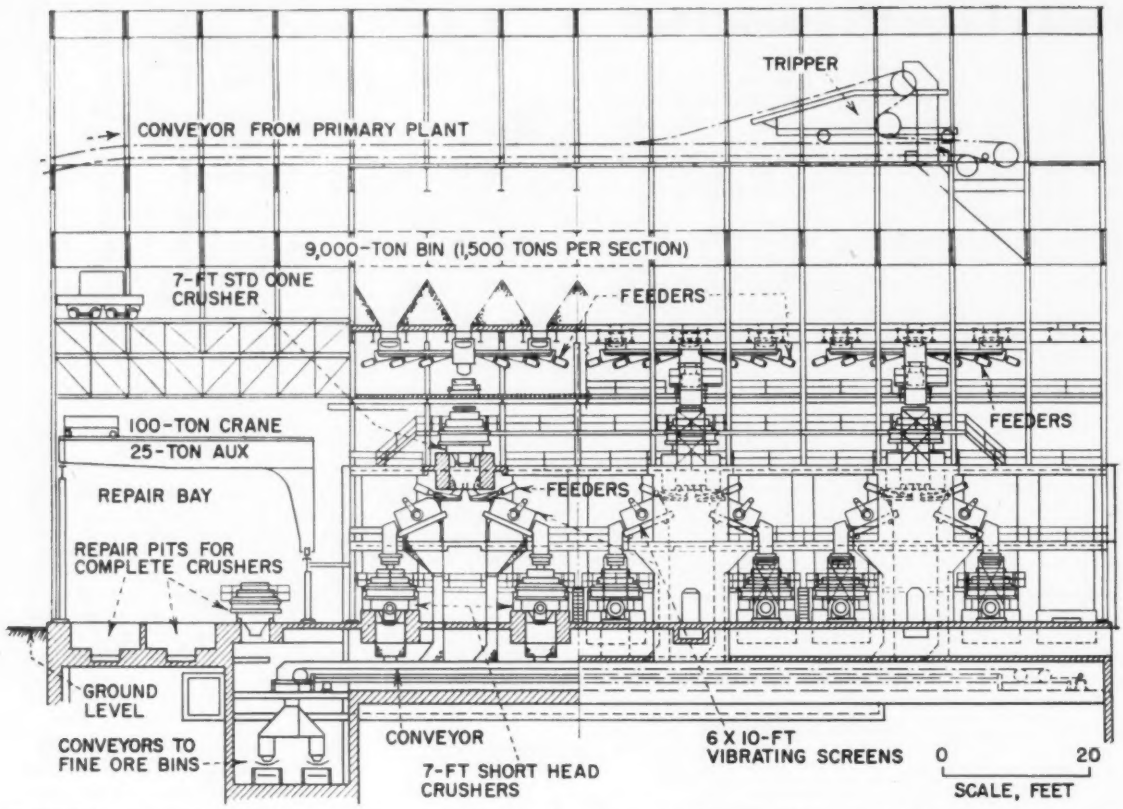
PRIMARY CRUSHING PLANT uses 2-stage reduction to minus 5-in. Note the special provision of rooms for auxiliary equipment such as electrical controls, cable ducts and lubricating facilities. Crushers and transfer structures are totally enclosed to keep dust out of the plant atmosphere. A separate room is provided for dust-control equipment. The plan at ground level, shown above, includes the area around the four secondary crushers. Rock will pile up to form feed chutes. A large crane is installed which can pull out a complete 36-in. crusher for repairs.



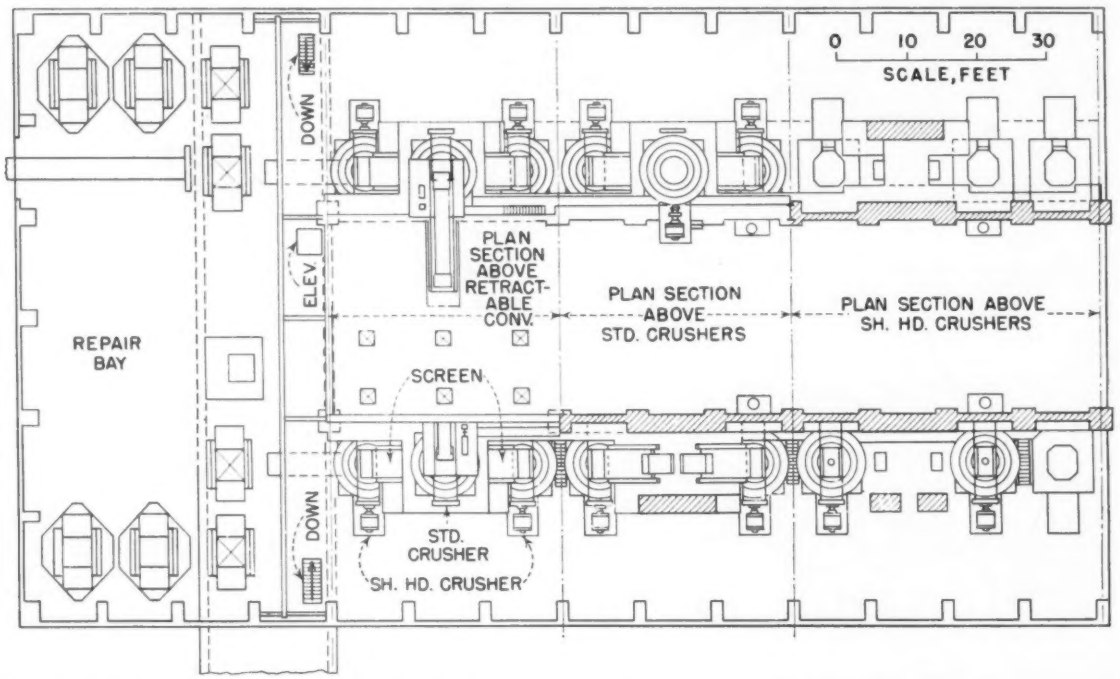


MINE CARS with capacity of 80 long tons are dumped by hydraulic control. The car doors open under control by the rotary dumper. The enclosed operator's control room is opposite the car and above the primary crusher throat to enable operator to see both dumping and crushing progress at all times.

ORE IS CRUSHED by a 60-in. gyratory crusher powered by a 900-hp motor, and four 36-in. secondary gyratory crushers each powered by 400-hp motors. Crushed ore is carried to the secondary crushing plant containing 18 cone crushers.

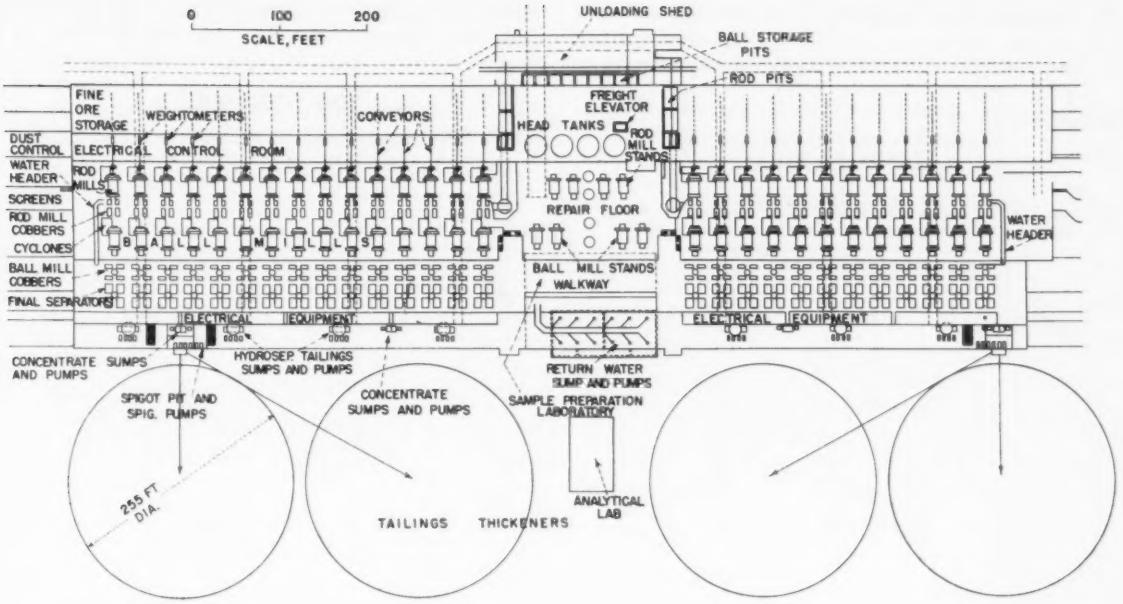


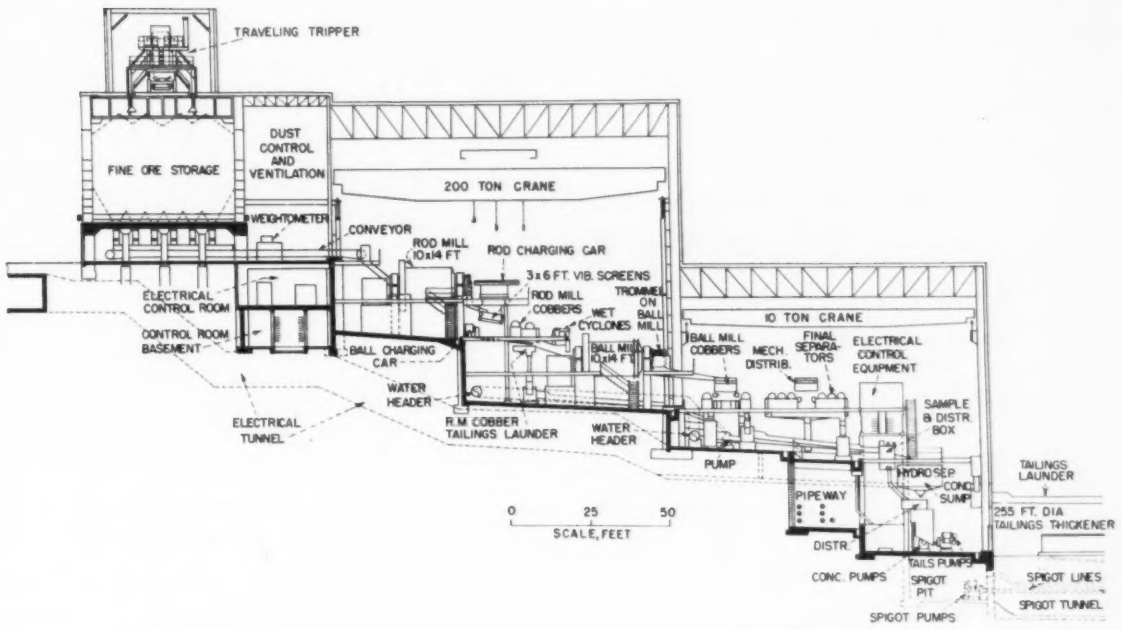
SECONDARY crushing plant uses Standard and Short-head cones to reduce 5-in. feed to about minus ¾ in. Note gantry-type construction on 100-ton repair bay crane so other cranes can lift complete crushers over into repair bay for relining.



PLAN of secondary crushing plant. Bin capacity will be kept low to minimize trouble with frozen ore. Vibrating feeders will draw bins down evenly, keep them empty in spring and fall. Abrasive ore will probably entail frequent relining jobs.

Erie Taconite. How the ore is processed.



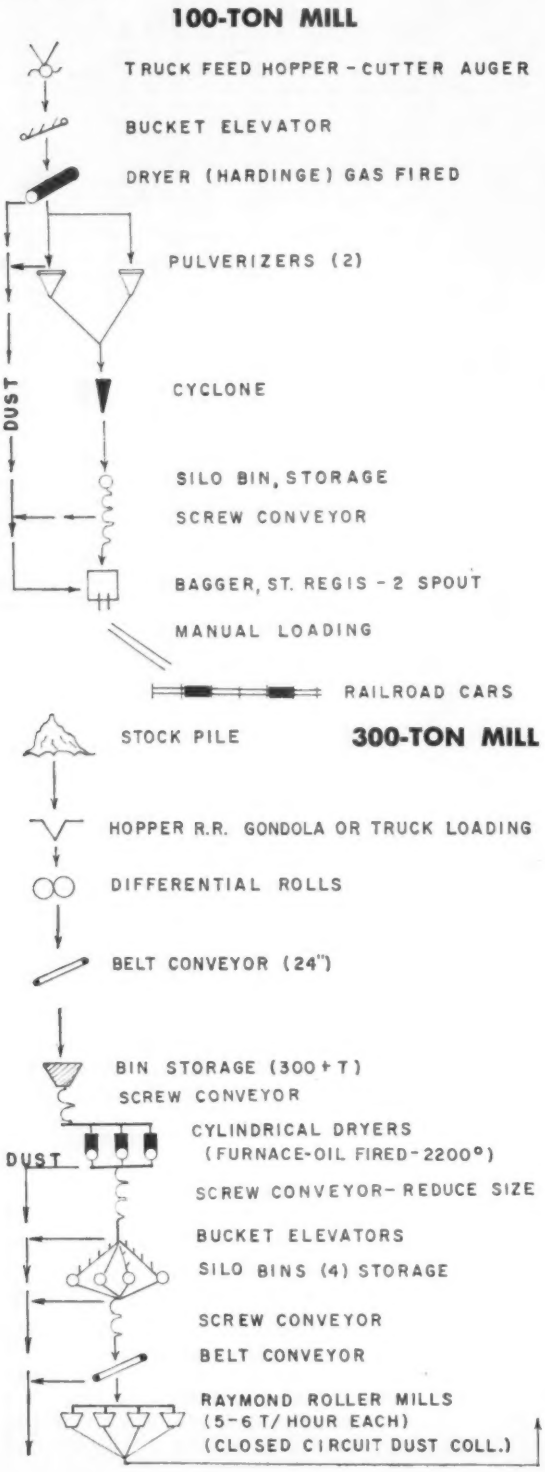


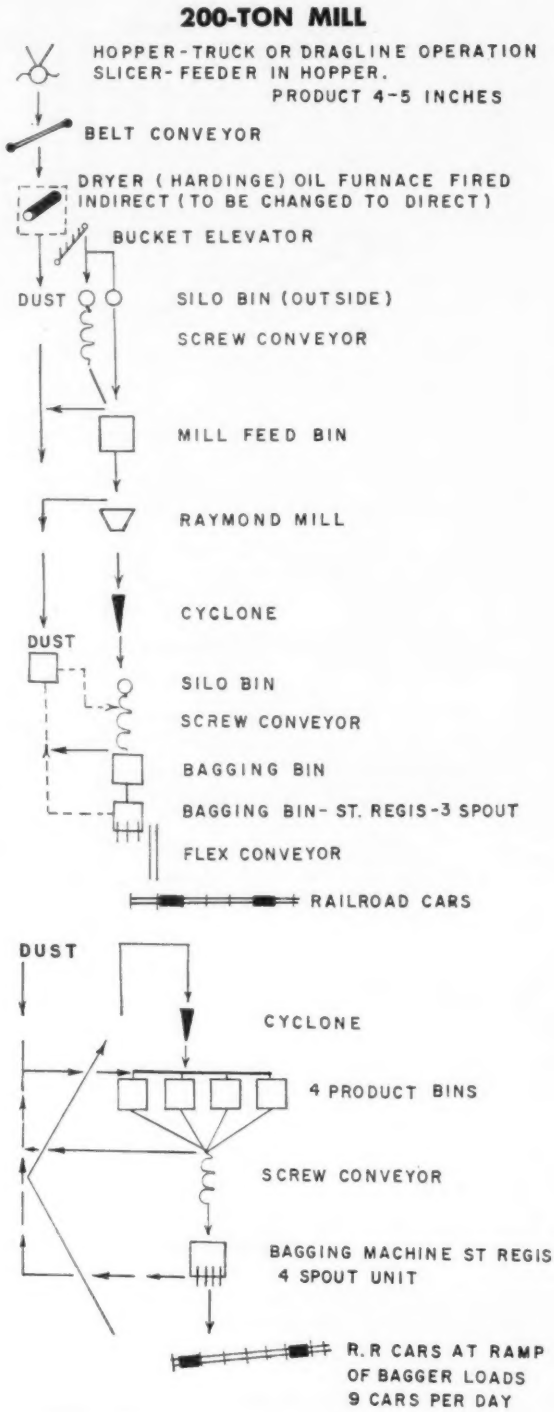
Simplified Flowsheet of Erie Concentrator

1. Fine ore storage bin, 54,000 tons.
2. Vibrating feeders, 18x90-in., 12 per unit, 324 in all.
3. Conveyor, 36-in., and belt scale lead to rod mills.
4. Rod mills, 10x14-ft. 15 on one side and 12 on other.
5. Rod mill discharge to one 5x8-ft vibrating screen, single deck, ¼-in. openings.
6. Ball mills, 10x14-ft, 27 in all. Trommel on discharge discards ⅛-in. oversize.
7. Magnetic separators, (ball mill cobbers) four single drum, permanent magnetic, counter-rotation separators, 36-in. dia, 60-in face per mill unit. 108 in all.
8. Five 14-in cyclones per unit.
9. Final magnetic separators, three-drum, 30-in. dia, 60-in. face. Four counter-flow separators per unit. 108 in all.
10. Magnetic separators, rod mill cobbers, two-drum, 36-in dia, 39-in face. Two countercurrent flow separators per unit, 54 in all.
11. Seven Hydroseparators, 18-ft dia, underflow at 45% solids.
12. Four thickeners, 255-ft dia, underflow at 45% solids.
13. Combined tailing at about 19% solids, minimum, to tailings pond.
14. Final concentrate pumped by slurry pump to thickener and filter in pelletizing plant. Concentrate is about 33% of original feed by weight. About 35% of feed goes into rod mill cobber tailing; about 18% into ball mill cobber tailing; about 14% into final separator tailing.

Bentonite Problem— What processes are available for upgrading the large tonnages of bentonite found in Wyoming? These three possible flowsheets were the reply to this question by Daniel S. Turner, Dan Turner & Associates, Denver, Colo.

Solution—

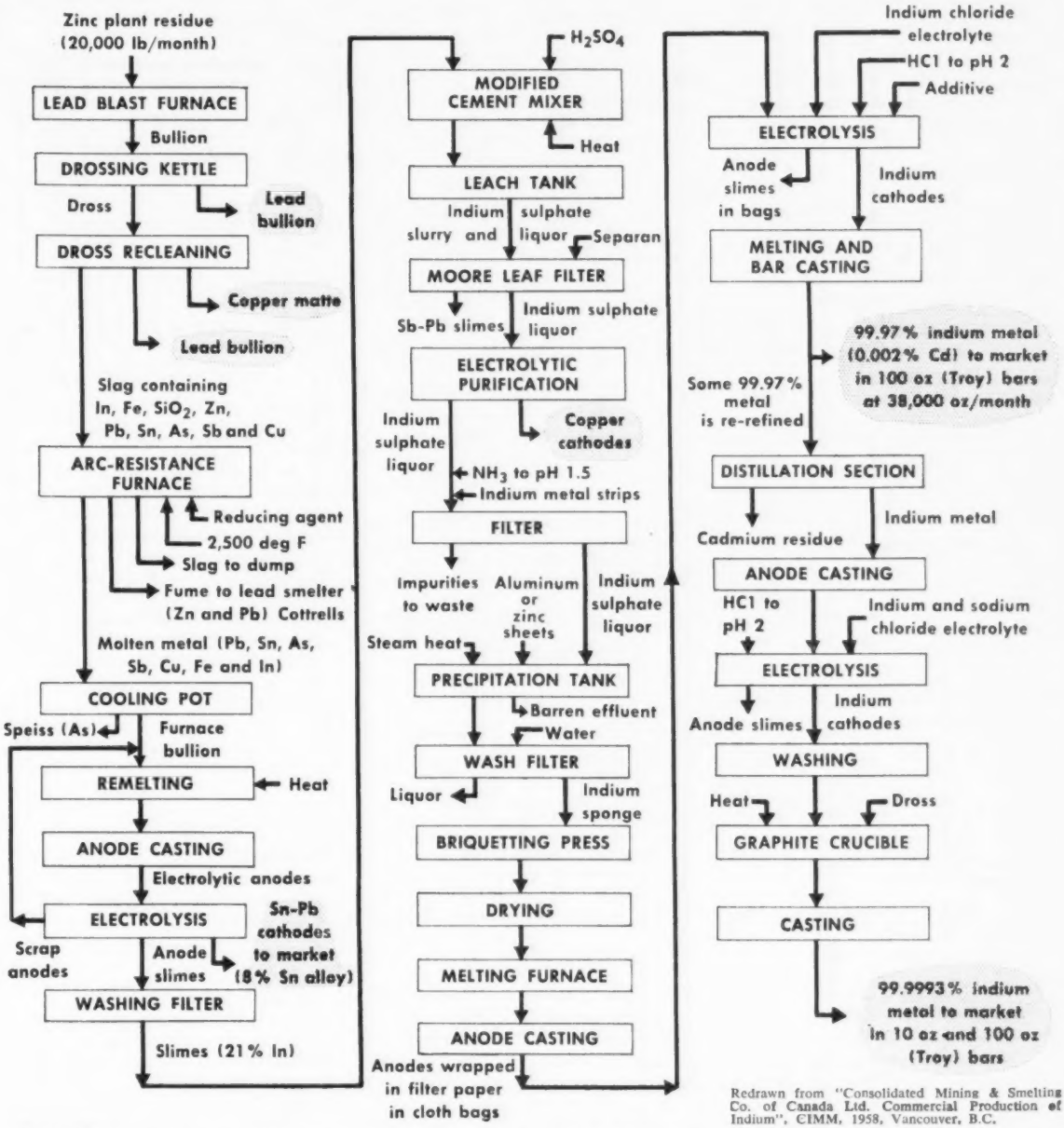




Results— The author feels that each of these three flowsheets will produce a marketable grade of bentonite. —Source Daniel S. Turner's "How to Mine and Mill Bentonite," E&MJ, July 1958, pp 108 to 110.

Indium Problem—To recover indium metal occurring in the dross retreatment furnace slag (a complex by-product of lead smelting) at Consolidated Mining & Smelting Co. of Canada Ltd.'s Trail, B.C. smelter. Furnace feed, prepared from the slag, is smelted with coke and limerock in an electric furnace. The furnace bullion is parted electrolytically, producing a marketable lead-tin alloy (8% Sn) and an anode slime high in indium. Anode slimes (containing 21% indium) are washed, leached and then purified as shown below.

Solution—

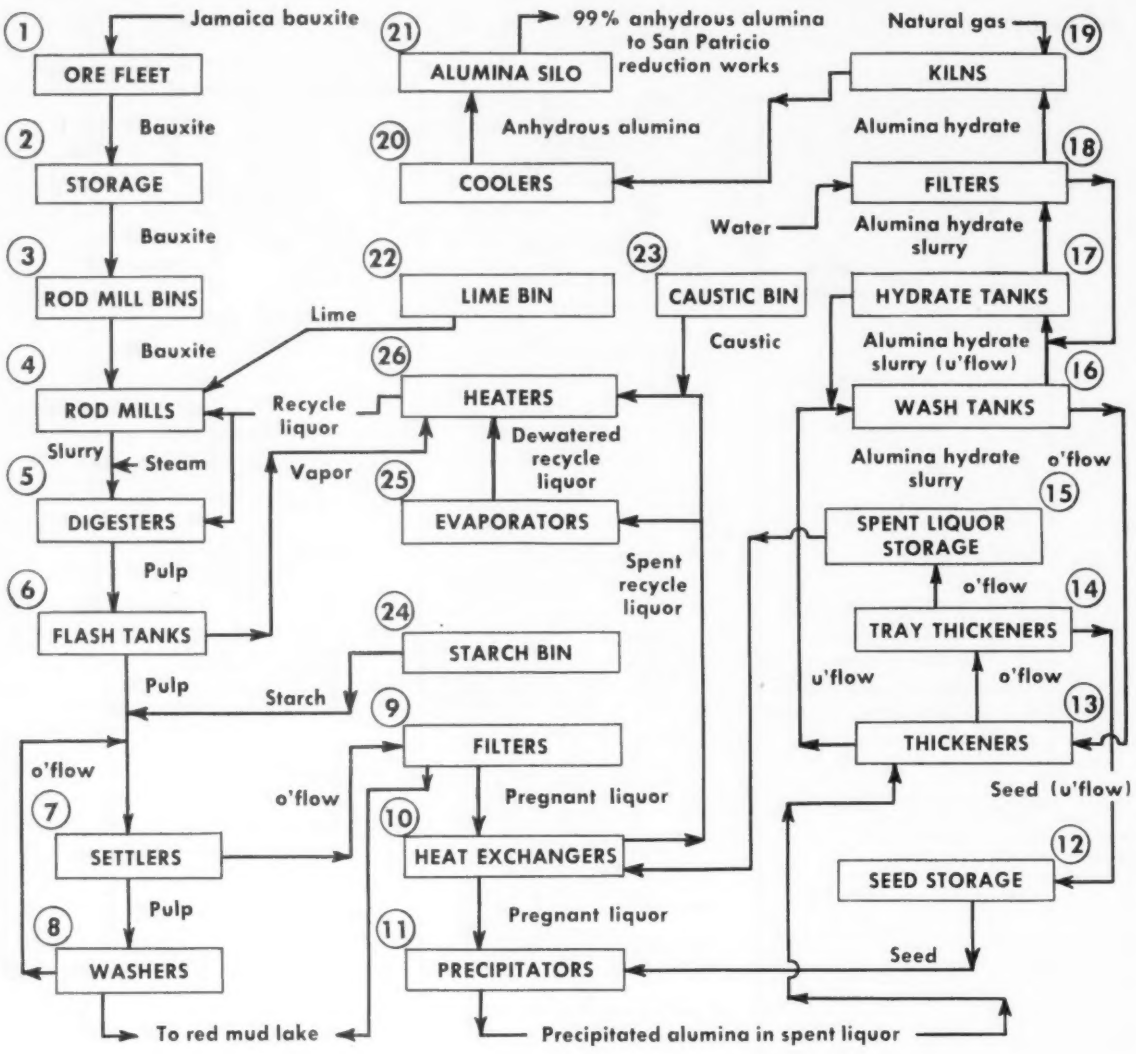


Redrawn from "Consolidated Mining & Smelting Co. of Canada Ltd. Commercial Production of Indium", CIMM, 1958, Vancouver, B.C.

Results—The process yields standard grade indium metal, 99.97% In, which may be sold as is or refined to Tadanac Brand high purity indium. Over 80% of the indium entering the indium recovery circuit originates in the zinc concentrates. The indium plant has been in operation since April 1955, and high purity metal has this typical assay—0.0002% Pb, 0.0002% Sn, 0.0001% Cd, 0.0001% Tl, 0.0001% Cu, 0.0002% Ni and 99.9993% In (by difference).—Source B. G. Hunt, C. E. T. White and R. A. King, "Consolidated Mining & Smelting Co. of Canada Ltd. Commercial Production of Indium," from CIMM 1958 as abstracted in E&MJ's June 1958 coverage of the Canadian Institute's annual meeting (p 86).

Bauxite Problem— To process Jamaican bauxite (minus 2 in.) to alumina, Reynolds Metals Co. devised the flowsheet below. Jamaican bauxite is rather low in silica, but high in iron; yet readily amenable to a modified Bayer Process. Minerals in the ore are predominantly gibbsite and boehmite. Grinding is to minus 20 mesh at the Sherwin plant, Corpus Christi, Texas. Process currently yields 2,000 tpd.

SOLUTION—



LEGEND

1. Jamaican bauxite (minus 2 in.) is delivered to Corpus Christi in four ore carriers owned by Reynolds subsidiary, Caribbean Steamship Co. Bauxite assays 40 to 49% Al_2O_3, 20 to 24% Fe_2O_3, 2 to 3% SiO_2, 2 to 3% TiO_2 and 13 to 15% moisture. Ore is unloaded by a Hewitt-Robins 48-in. pier belt and delivered over a Merrick Weightometer to another 48-in. Hewitt-Robins overhead bridge belt conveyor for storage in the bauxite building
2. Bauxite is reclaimed on a 30-in. belt at approximately 70 tph and delivered to the grinding mill bins. Merrick Weightometer used ahead of the bins
3. Grinding mill bins, 350 ton capacity
4. Grinding mills (five) are Hardinge 6x10-ft rod mills using 2-, 3- and 4-in. balls or 3-in. rods depending on the type of ore being ground. Spent liquor is used to slurry the mill feed. Mills discharge at minus 20 mesh and 45% solids. Lime is added at the rate of 50 to 150 tpd
5. Slurry is digested in any of four digester series (each with three 10-ft dia by 30 ft units). A series operates with retention time or 30 minutes at 400 deg F, 200 psi (300 lb steam used). Digesters are top feed, bottom discharge
6. Digested slurry containing the dissolved alumina enters a train of flash tanks where steam pressure is reduced (along with temperature) in four steps. Flash goes to the preheaters (No. 26). Slurry and dissolved alumina goes to settlers
7. Feed pulp enters the settlers—seven parallel four-deck, balanced-type tray thickeners. (40-ft dia) and four 90-ft dia single deck thickeners. Feed is split to these eleven as needed to maintain

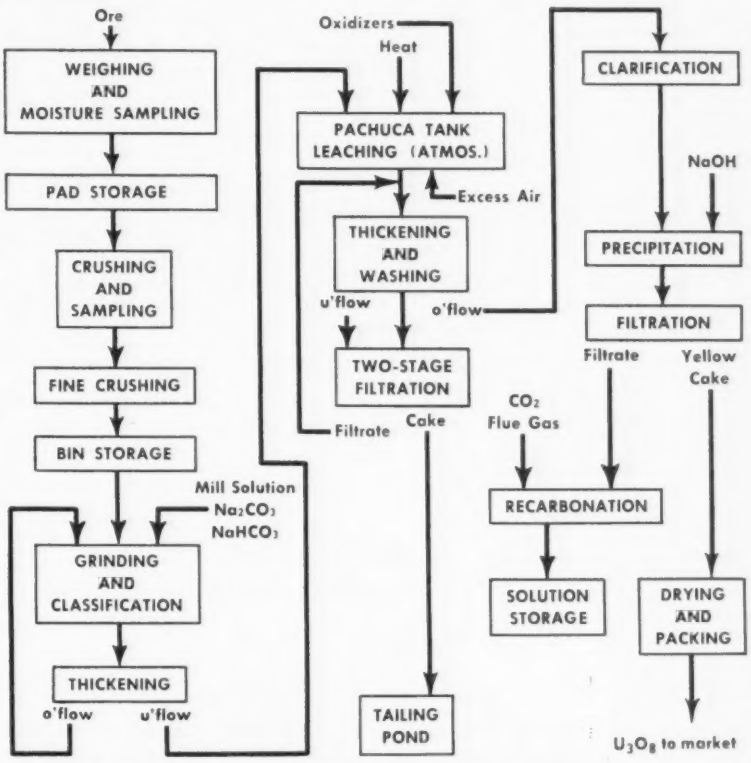
flow rates. Overflow goes to the Kelly-type filters and contains most of the dissolved alumina and some suspended red mud. Underflow is thickened red mud and passes to the washers

8. Red mud underflow, containing some valuable soda and alumina, enters any of eleven 5-deck, 55-ft dia continuous countercurrent washing tray thickeners. Overflow goes to the settler feed, returning residual alumina and soda to the process. Underflow is mostly thickend red mud which passes to two 175-ft dia final continuous countercurrent single-deck washer-settlers. Overflow from the final settlers goes back to first washers. Underflow is red mud and goes to the red mud lake which consists of multiple drying beds covering several hundred acres
9. Overflow from the settlers (No. 7) containing the alumina is filtered and washed in 38 Kelly-type filters which have stationary leaves and movable shells. 28 have 1,000 sq ft of cloth area, 10 have 2,000 sq ft. Clarified pregnant liquor goes through the heat exchangers and into the precipitators
10. Heat exchangers cool pregnant liquor to about 150 to 160 deg F, transferring the heat to spent process liquor going bock to evaporators (No. 25)
11. Pregnant liquor enters any of the 218 precipitator tanks (200,000 gal capacity). Each is 24-ft dia by 60-ft straight, plus cone bottom, pachuca type. Precipitator is filled with pregnant liquor containing 80 grams per liter alumina, seeded with fine alumina from seed storage, then circulated with air agitation. Air supply is important—to agitate, and to keep alumina from building up on the pachuca walls. Three 6,000 cfm compressors—two Ingersoll-Rand steam and one I-R electric—supply the air
12. Seed storage tanks
13. Secondary thickeners (six) are 42-ft dia by 27-ft straights with cone bottom. Overflow is seed to tray thickeners. Underflow is crystalline alumina trihydrate and goes to wash thickeners
14. Tray thickeners recover some additional seed for seed tank, sends overflow to spent liquor. Thickeners are nine in number, each 40-ft dia tray type
15. Spent liquor storage
16. Wash tank gives hydrate another countercurrent wash, sends alumina to hydrate tank
17. Hydrate tank
18. Fourteen Dorrco internal filters, 12 ft by 7-ft dia, coilect and wash alumina with effluent going to spent liquor tank
19. Alumina is dehydrated in seven countercurrent Unax-type F. L. Smidth kilns, gas-fired to 2,100 deg F. Kilns are 11-ft dia by 220 ft
20. Fuller Co. Airslide conveyor-coolers reduce temperature of kiln discharge
21. Alumina silo, 6,000 ton capacity
22. Lime bin. Lime is fed to grinding mills at 50 to 150 tpd
23. Caustic bin. Consumption is about 100 tpd into spent liquor going through heaters to the digesters
24. Starch bin. Feed rate is 20 tpd to the settler feed as a mud settling aid
25. Evaporators (combined forced and natural circulation type) distill out about 2,000 gpm water from the spent solution
26. Heaters preheat concentrated spent liquor after caustic addition and before liquor enters digester stage. Some liquor goes to the grinding mills

Results— Leach time is not too important at Corpus Christi—Reynolds uses 30 minutes contact time at 200 psi and 400 deg F in the pachucas. Caustic concentration and temperature of the leach are closely controlled. Bauxite is processed at about 70 tph through the grinding section and into the digesters. After passing through heat and pressure reducing steps, the pregnant liquor is treated as shown.—Source E&MJ, May 1959, pp 98 to 101, based on plant visit in 1958.

Uranium Problem- To process Ambrosia Lake Westwater Canyon sandstone from the Morrison formation, the uranium-bearing sandstone occurring in pods and lenses of various size and location. All the ore is associated with a black asphaltic residue. Homestake-New Mexico Partners draws ore from Rio de Oro and H-NMP's Mine 32, in addition to some custom ore. The mill and flowsheet were implemented by the operating partner, Clyde E. Osborne, well known mining metallurgist.

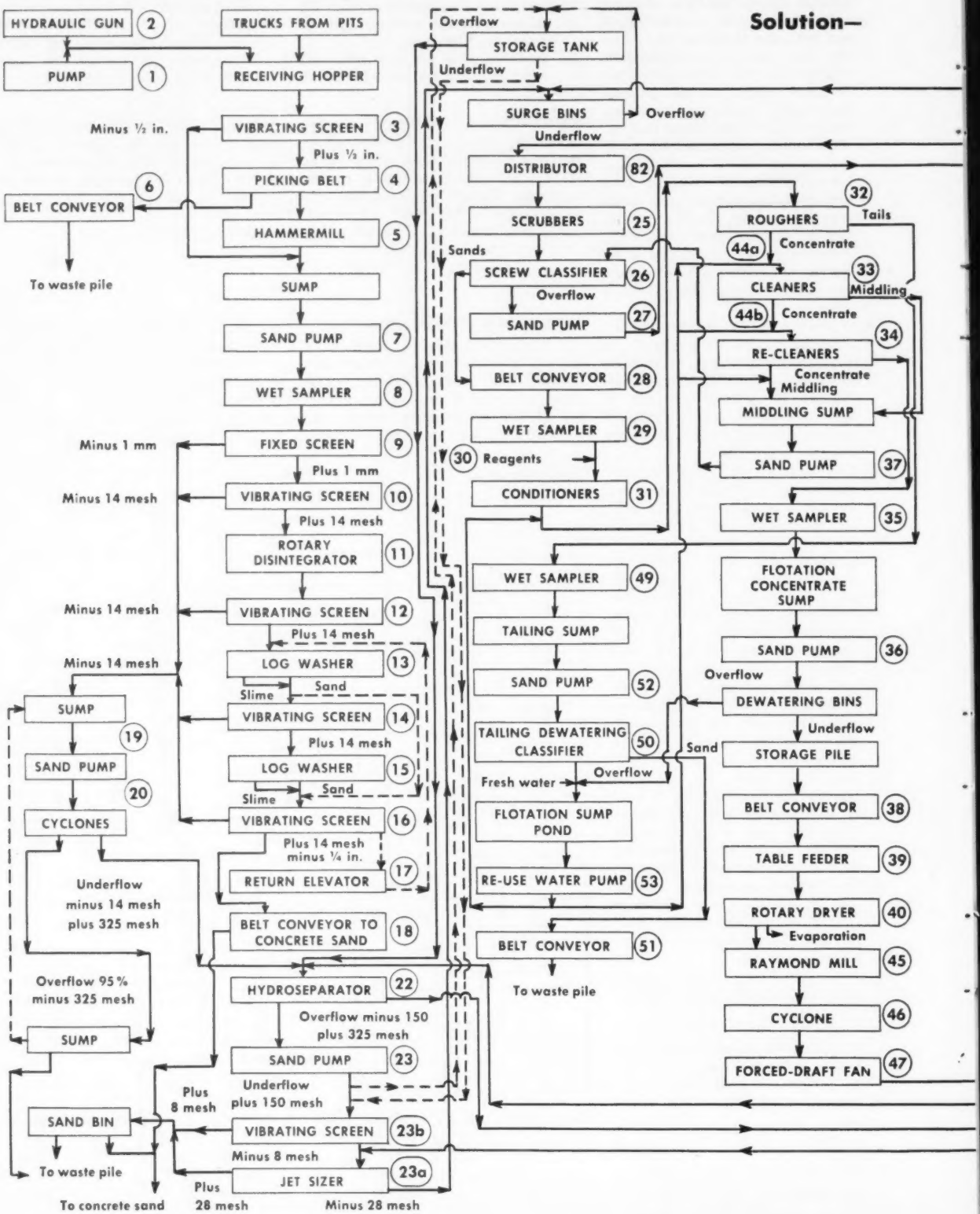
Solution—

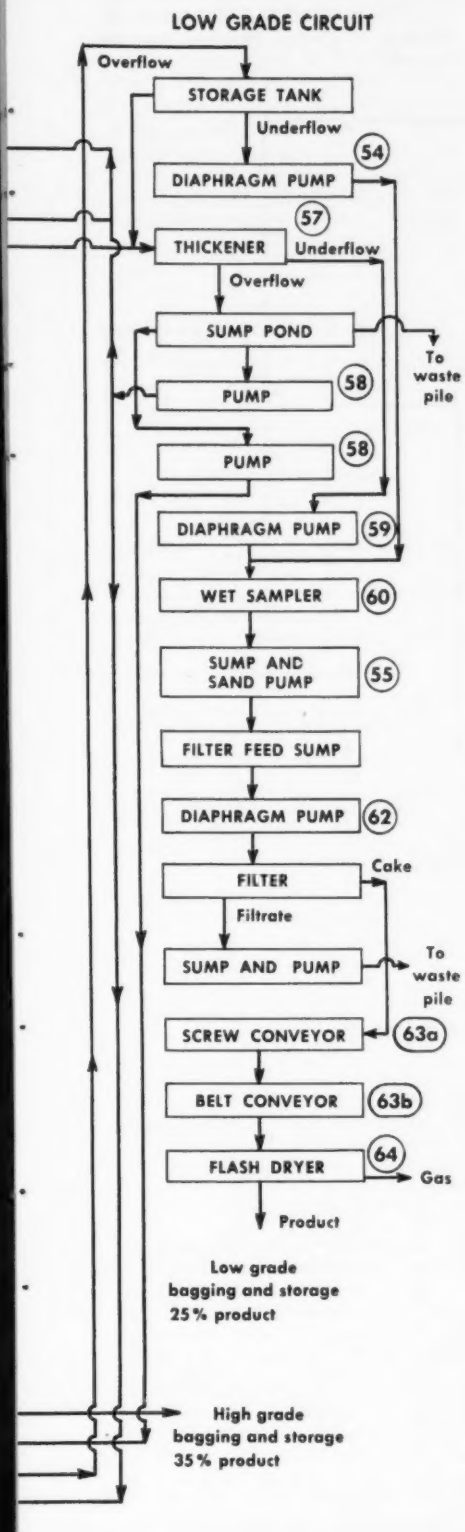


Results— Caustic precipitation of the uranium dissolved through carbonate leaching yields a yellow cake of AEC specifications. Grinding is to 65 mesh in a ball mill-classifier circuit with the overflow being thickened to 50% solids. Leaching is in pachuca tanks at 180 deg F for 36 hours. Boiler house stack gases are the source of the CO_2 used in recarbonation of the mill solution.—Source E&MJ, June 1958, p 150.

Phosphate Problem— To treat an orebody containing collophanite, in which the coarse phosphate is lighter than the gangue and the fine heavier, at Fosforita Olinda, S. A., Recife, Pernambuco, Brazil.

Solution—





LEGEND

1. Two 6x8-in. water pumps, 100 hp each
2. Two hydraulic guns, 1600 gpm at 70 psi
3. Vibrating screens, 5-ft x 12-ft 2½-in. top deck, ½-in. bottom deck, 10 hp
4. Picking belt conveyor, 36 in. x 28 ft
5. Non-clog hammer mill, 36x30-in., Penn-Dixie
6. Belt conveyor, 24 in. x 85 ft, 3 hp
7. Sand pump, 10x8 in., 125 hp
8. Automatic standard-duty wet sampler
9. Stationary screen, 4x10 ft
10. Vibrating screen, 5-ft x 8-ft ¼-in. top, 14-mesh bottom, 10 hp
11. Wemco rotary disintegrator, 6x6 ft, 75 hp
12. Vibrating screen, single deck, 5x8 ft
13. Duplex log washer, 30 in. x 30 ft. 50 hp
14. Vibrating screen, single deck, 5x8 ft
15. Duplex log washer, 30 in. x 30 ft, 50 hp
16. Vibrating screen, 5-ft x 14-ft ¼-in. top, 14-mesh bottom, 10 hp
17. Bucket elevator, 8-in. buckets, 52 ft
18. Belt conveyor, 18 in. x 79 ft, 3 hp
19. Three sand pumps, 8x6 in., cyclone feed,
20. Twelve Krebs cyclones, D-10-B
22. Hydroseparator, 30-ft dia, Dorr "AX"
23. Sand pump, 8x6 in., Hydroseparator underflow, 75 hp

23a. Dorrco jet sizer

23b. Vibrating screen, 5x8 ft, single deck, .096-in. opening, 5 hp

25. Twelve Fagergren scrubber cells, 56x56 in., 20 hp each
26. Wemco screw classifier, 60 in. x 35 ft 9 in., Series 150, 7½ hp
27. Sand pump, 6x4 in., classifier overflow
28. Belt conveyor, 18 in. x 83 ft, 3hp
29. Automatic wet standard-duty sampler
30. Two Clarkson Duplex reagent feeders, No. E2, 1/20 hp each
31. Three Wemco conditioners, 4x4 ft, extra heavy duty, 10 hp each
32. Ten Fagergren rougher cells, 56xb6 in.
33. Four Fagergren cleaner cells, 56x56 in.
34. Four Fagergren re-cleaner cells, 56x56 in., 15 hp each cell, ¼ hp each machine
35. Automatic wet standard-duty sampler
36. Two sand pumps, 6x4 in., flotation concentrate, one stand-by, 40 hp
37. Two sand pumps, 6x4 in., flotation middling, one stand-by, 10 hp
38. Belt conveyor, 18 in. x 282 ft, 5 hp
39. Table feeder, 60-in. Hardinge, 2 hp
40. Rotary direct oil-fired Hardinge "XH"-10 dryer, 70 in. x 60 ft, 30 hp
41. Multiclone rotary air-lock dust collector
42. Clarage No. 129 XL induced-draft fan
43. Bucket elevator, 10 in. x 47 ft 7 in. long

44a. Screw conveyor, 12 in. x 48 ft long, 5 hp

44b. Screw conveyor, 12 in. x 82 ft long, 5 hp

45. Two No. 6669 Hi-side roller mills and Whizzer separator
46. Two cyclone collectors, 12-ft dia
47. Two forced-draft fans of 150 hp each
48. Two Denver-Vezin automatic dry samplers, 40 in., dust tight, 1 hp
49. Automatic wet standard-duty sampler
50. Wemco screw classifier, Series 150
51. Belt conveyor, 18 in. x 79 ft, 3 hp
52. Two sand pumps, 6x4 in., one stand-by
53. Two re-use water pumps, 6x5 in., one stand-by, sump pond, 30 hp
54. Duplex diaphragm pump, 4 in., 50-ft
55. Two sand pumps, 6x4 in., one stand-by, underflow to filter feed sump, 30 hp
56. Two 2-in. Oliver Type L filtrate pumps, one stand-by, 10 hp
57. Dorrco thickener, 150 dia, 3 hp

58a. Two water pumps, 12x12 in., sump pond overflow, one spare water pump

58b. Two water pumps, 8x8 in., sump pond overflow, one stand-by, 100 hp

59. Two duplex diaphragm pumps, 4 in.

60a. Two automatic wet standard-duty samplers (2 cutters), ½ hp

61. Three Dorr-Oliver disc filters, 8½ ft dia
62. Three 4-in. Dorr-Oliver diaphragm pumps, filter feed, one stand-by

63a. Screw conveyor, 12 in. x 56 ft, 5 hp

63b. Belt conveyor, 18 in. x 43 ft 6 in., 3 hp

64. Cage mill, flash dryer, 30-in. double-paddle mixer, 50-hp mill, 40-hp mixer
65. Cyclone collector, 16-ft dia
66. Forced-draft fan, American Blower 900, type "E", 250 hp
67. Multiclone rotary air-lock collector, No. 80-8, ½ hp
68. Wet scrubber and circulating pump, 5 hp

69a. Screw conveyor, 12 in. x 24 ft. 5 hp

69b. Three 12-in. rotary cut-off valves

70. Denver-Vezin automatic dry sampler

71a. Screw conveyor, 12 in. x 18 ft, 3 hp

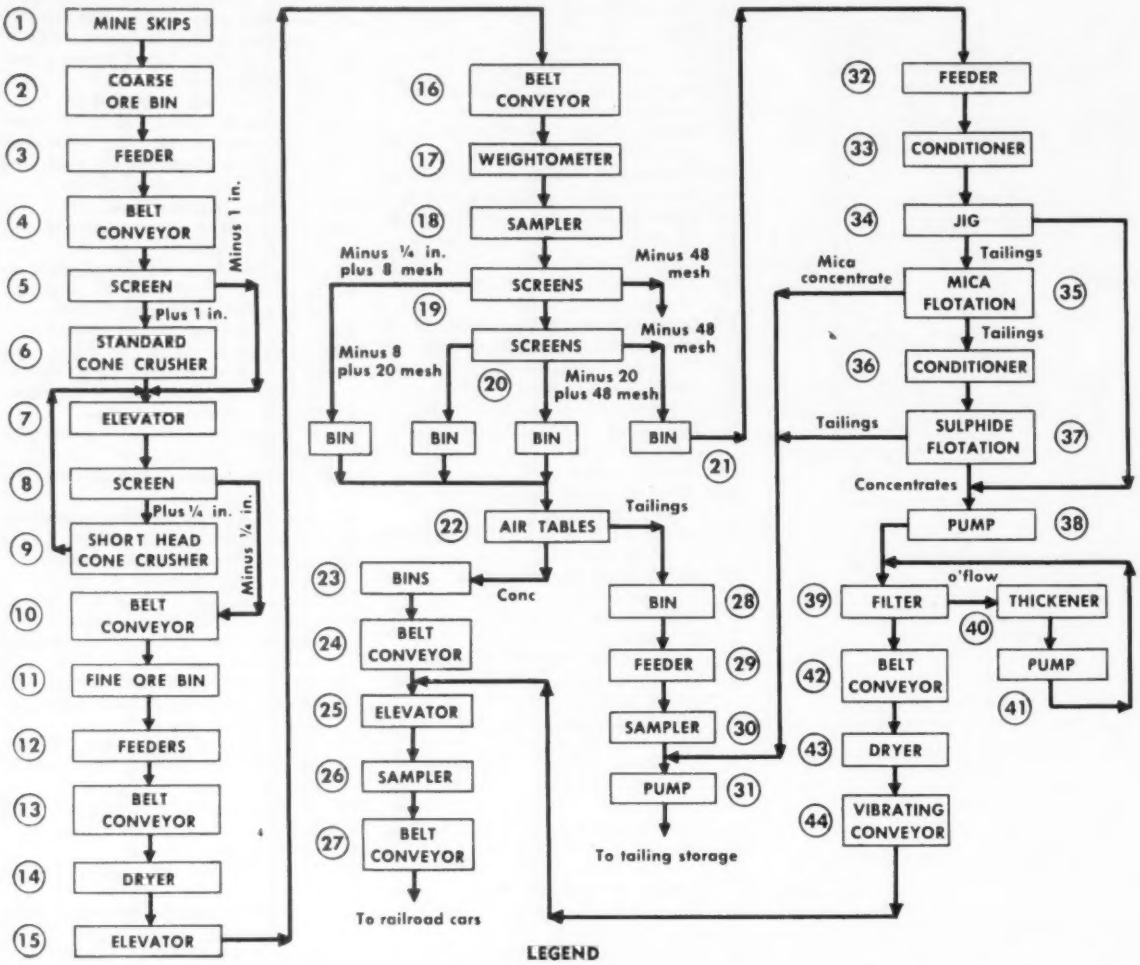
71b. Screw conveyor, 12 in. x 19 ft, 3 hp

72. Richardson No. E50-Automatic bagging machine, 2½ hp
73. Sewing machine and bag conveyor, 1¼ hp
74. Two Richardson No. E50-Automatic bagging machines, 2½ hp
75. Two sewing machines and bag conveyors
76. Three flat-belt conveyors, 24 in. x 43 ft 6 in., 5 hp each
77. Richardson automatic bagging scale, 500 lb, 3 hp.
81. Platform scale
82. Pulp distributor, self rotating, 5 ft x 3 ft 10 in., 2-way split
83. Seven rotary vane packer feeders, 3 hp
84. Dust collector and exhaust fan, 10 hp
85. Clarkson reagent feeder, Type E-2
86. Three Nash Hytod "L-7" vacuum pumps
87. Vacuum receiver, 60x84 in.
88. Screw conveyor, 9 in. x 35 ft, 3 hp
89. Roots-Connersville "AF-59" blower
90. Two oil pre-heaters rotary dryer, 20 hp, flash dryer, 25 hp
91. Two fuel oil pumps, feed pump, 10 hp, circulating pump, 8 hp
92. Three reagent pumps, 3 hp
93. Two booster water pumps, 5x4-in. receiving plant, 30 hp each
94. Water pump, 10x8 in., slime pump, 125 hp
95. Water pump, 10x8 in., 75 hp

Results—Mineralogically the Olinda deposit contains collophanite as a fossil replacement in a gangue of quartz, feldspar and illite clay. Processing, while similar to the Florida pebble operations, differs somewhat due to the condition mentioned above, the differences in grain structure and the percentage of phosphate occurring in the fines. Fosforita produces 250,000 tons of concentrate a year in two grades—a 76.3% BPL and a lower grade (54.5% BPL) that is used locally as a fertilizer, the high-grade being exported overseas.—Source W. H. Evans' "How Fosforita Olinda, S. A. Processes Brazilian Phosphate," E&MJ, May 1959, pp 86-93.

Pyrrhotite Problem — To produce a high-grade sulphur-bearing concentrate from sulphide ore mined at the Gossan mine, Galax, Va., General Chemical Div., Allied Chemical Corp. developed the flowsheet below. Pyrrhotite is liberated at about 3 mesh. Plus 48 mesh is air tabled, while the minus 48 is froth floated. Capacity is 1,100 tpd ore. Fines are handled in Denver jigs and then by flotation.

Solution—



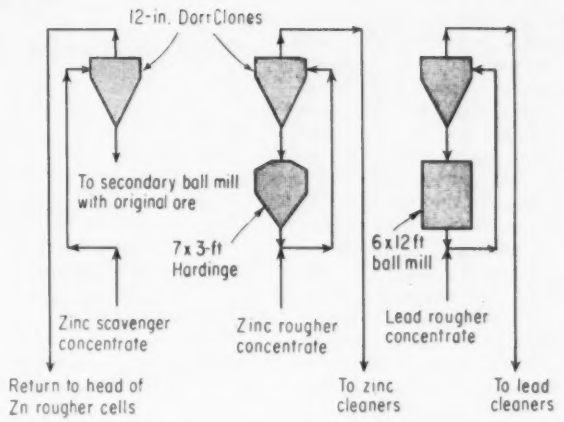
LEGEND

1. 5-ton combination Kimberly skip-cages
2. 100-ton, live load, ore bin
3. Robbins 33-in x 7-ft reciprocating feeder; feed rate, 76 tph
4. 24-in. x 34-ft belt conveyor, stationary magnet overhead pulley
5. 4x6-ft Tyler Niagara screen
6. 4-ft Symons Standard Cone Crusher set at ¾-in.
7. 8-in. x 12-in. x 57-ft high bucket elevator
8. 4x8-ft Allis-Chalmers double deck vibrating screen. ½-in. punched plate top deck, ¼-in. screen lower deck
9. 3-ft Symons Short Head cone crusher
10. 18-in. x 37-ft belt conveyor
11. 20-ft dia steel fine ore bin. Capacity of 500 live tons
12. Two Jeffrey 3MC vibrating feeders
13. 16-in. x 60-ft conveyor
14. 6-ft dia x 36-ft long Vulcan rotary dryer, coal fired
15. 8-in. x 12-in. x 55-ft bucket elevator
16. 18-in. x 75-ft belt conveyor
17. Merrick Model E Weightometer
18. Galigher Co. Geary-Jennings sampler
19. Two Tyler 3x10-ft double deck Hummer screens, 8 mesh Tyrod screens, top deck; 48 mesh s.s. Ton Cap screen lower deck
20. Same as No. 19 except 20 mesh. Ton Cap screens top deck; 48 mesh Ton Cap screens lower deck
21. Four 50-ton steel bins
22. Nine Sutton Steele & Steele 50x70-ft air separators. Three for each size
23. Two 50-ton concrete and steel concentrate bins
24. 18-in. x 36-ft belt conveyor
25. 5-in. x 8-in. x 53-ft high bucket elevator
26. Galigher, Geary-Jennings sampler
27. 18-in. x 20-ft belt conveyor
28. 50-ton concrete and steel dry tailings bin
29. Jeffrey 3L vibrating feeder
30. Denver Equipment automatic sampler
31. Two Morris 3R slurry pumps
32. Hardinge constant weight feeder
33. 3x5-ft Denver conditioner
34. Denver 12 x 18-in. Duplex mineral jig
35. Denver No. 250 unit cell
36. Denver 5x5-ft Super Agitator-conditioner
37. Two flotation banks. One 4-cell No. 36 Agitair; one 2-cell Denver No. 18, and 2-cell No. 36 Agitair
38. Wilfley 2-in. sand pump
39. Dorrco 8x4-ft filter. Nash L-5 vacuum pump; Hydroseal 1½-in. filtrate pump
40. Denver 24-ft dia x 20-ft high thickener
41. Denver 4-in. Simplex diaphragm pump
42. 12-in. x 16-ft belt conveyor
43. 5x36-ft Vulcan rotary dryer
44. Witte 24-in. vibrating conveyor

Results— General Chemical treats 25% S ore and gains a 33.7% S concentrate with an 8% S tail. General Chemical ships concentrate to acid plant at Pulaski, Va.—Source E&MJ, April 1959, pp 114-118.

Grinding Problem— To properly grind an ore containing galena, sphalerite and pyrite in a calcite-dolomite gangue in which the galena is fine grained and the sphalerite is considerably coarser. Intergrowth of one sulphide in another is rare, but grinding through 325 mesh is required to give adequate liberation. Canadian Exploration Ltd., Salmo, B.C., after considerable experimentation, developed the regrind circuit shown here.

Solution—

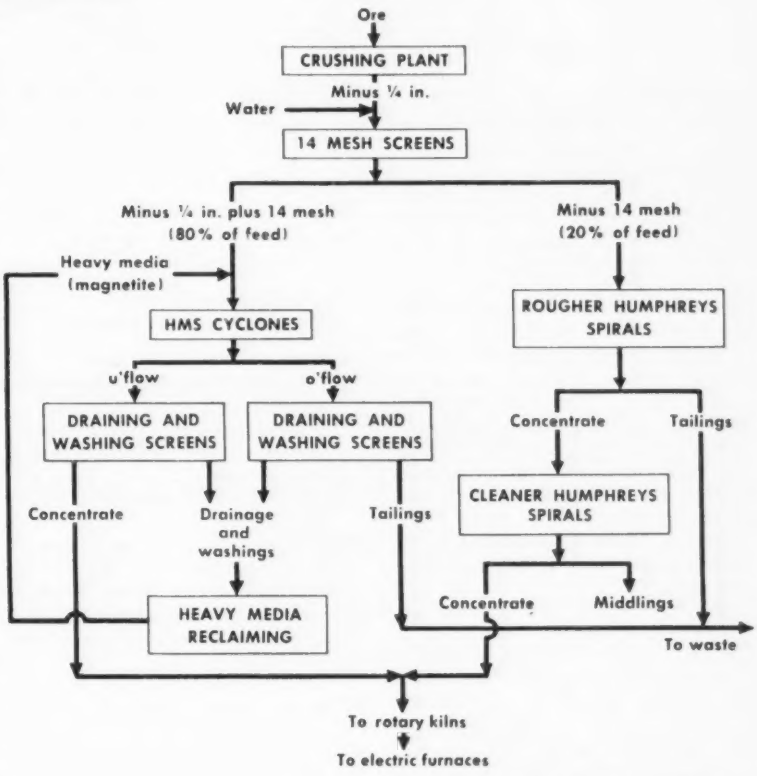

12-in. DorrClones
To secondary ball mill with original ore
7 x 3-ft Hardinge
6 x 12 ft ball mill
Zinc scavenger concentrate
Zinc rougher concentrate
Lead rougher concentrate
Return to head of Zn rougher cells
To zinc cleaners
To lead cleaners

Redrawn from H. A. Steane's "Regrind Practice at Canadian Exploration Ltd.", CIMM 1958, Vancouver

Results— There are two regrind circuits at Salmo, one on the lead, and one on the zinc side. In each unit, the rougher concentrate is reground ahead of the cleaners. Since the initial installation, the plant throughout has been increased gradually from 1,600 to 2,000 tpd, and a coarser, over-all grind has been accepted with mill tailings running 55 to 45% minus 200 mesh. There has been no increase in grinding capacity, but two mills have been taken from the main grinding circuit and installed in the regrind sections. The regrind flowsheet has produced these typical results since March 1957—lead concentrate runs 77% Pb, 4% Zn and 1% Fe; zinc concentrates assay 1.3% Pb, 58.5% Zn and 5% Fe; tailings read 0.15% Pb and 0.29% Zn—Source H. A. Steane's "Regrind Practice at Canadian Exploration Ltd." at CIMM 1958 and abstracted in E&MJ, June 1958, p 88.

Titanium Problem — To process ilmenite closely associated with hematite in which the ore assays about 32% TiO_2 and 36% Fe at Lac Tio in the Allard Lake region of Quebec. Pyrite is interstitial to the ilmenite grains. Hematite lamellae sometimes traverse the whole grain of the ilmenite particles and may be as large as 100 microns in width. Needles of ilmenite are also visible in the hematite grains. It appears impossible to separate these two minerals by mechanical means. Also, magnesia is present at up to 8% concentration. Quebec Iron & Titanium Corp. mines the Allard Lake deposit to feed the electric furnaces at Sorel, Quebec, and employs this flowsheet.

Solution—

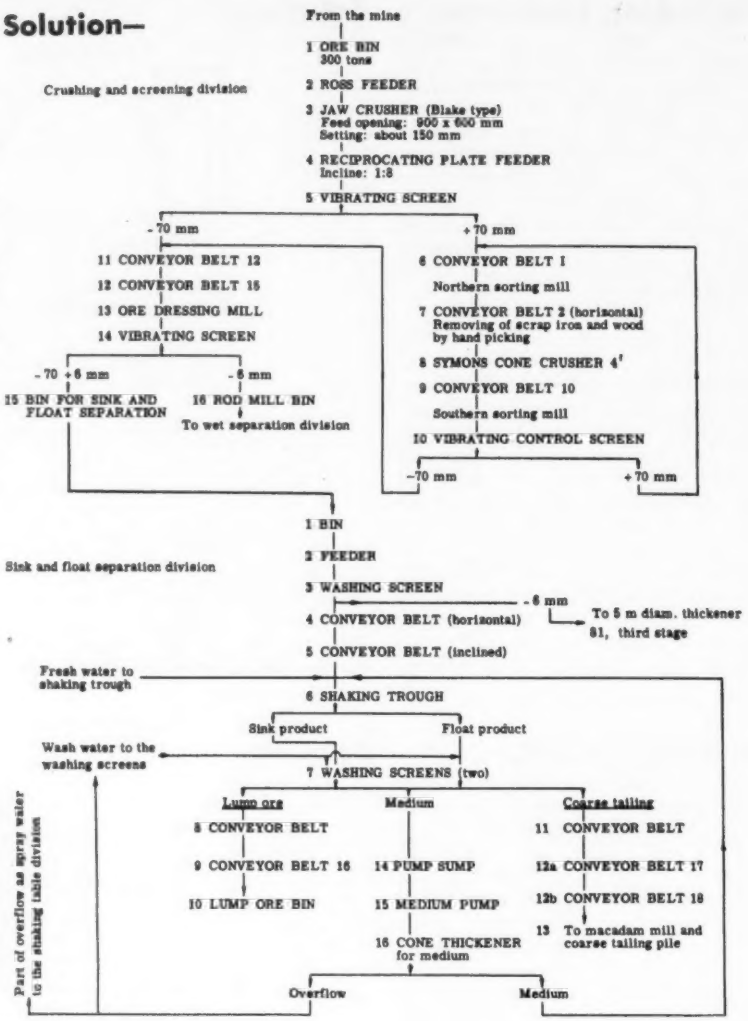


Redrawn from R. A. Elliott's "Beneficiation of Titanium Ores With Particular Reference to Canadian Ores", CIMM, 1958, Vancouver, B.C.

Results— A concentrate is obtained through crushing, screening, heavy media separation and spirals that contains 95% combined ilmenite-hematite with 4% chemically combined magnesia and about 1% gangue. Sintering removes most of the sulphur present. Sorel produces pig iron and a 90 to 95% TiO_2 slag which is ground and processed to pigment grade.—Source R. A. Elliott's "Beneficiation of Titanium Ores With Particular Reference to Canadian Ores," CIMM 1958 and abstracted in E&MJ, June 1958, p87.

Sink-Float Problem—To concentrate by sink-float separation an ore containing both magnetite and hematite, quartz, epidote, actinolite and diopside, the Stripa mine developed the Stripa Sink-Float Separator to treat 200,000 tpy on one shift. Main orebody runs 50% Fe and 0.007% P; the other, called the "Parallellmalmen" running 45% Fe and 0.14% P. The main mineral, hematite, is developed as grains 0.2 to 0.6 mm, slightly elongated in the bedding plane. Porphyroblastic magnetite (up to 10%) may be as large as 15 mm, but the normal size is from 0.5 to 5 mm. It is more seldom martitized. Of the skarn silicates occurring in the hematite bands, actinolite and diopside are light-colored and have low iron content, whereas the not so freely occurring epidote is rich in iron and green in color.

Solution—


From the mine
1 ORE BIN 300 tons
Crushing and screening division
2 ROSS FEEDER
3 JAW CRUSHER (Blake type) Feed opening: 900 x 600 mm Setting: about 150 mm
4 RECIPROCATING PLATE FEEDER Incline: 1:8
5 VIBRATING SCREEN
-70 mm
+70 mm
11 CONVEYOR BELT 12
12 CONVEYOR BELT 15
13 ORE DRESSING MILL
14 VIBRATING SCREEN
6 CONVEYOR BELT 1
Northern sorting mill
7 CONVEYOR BELT 2 (horizontal) Removing of scrap iron and wood by hand picking
8 SYMONS CONE CRUSHER 4'
9 CONVEYOR BELT 10
Southern sorting mill
10 VIBRATING CONTROL SCREEN
-70 +6 mm
-6 mm
15 BIN FOR SINK AND FLOAT SEPARATION
16 ROD MILL BIN
To wet separation division
-70 mm
+70 mm
1 BIN
2 FEEDER
Sink and float separation division
3 WASHING SCREEN
-6 mm
To 5 m diam. thickener 81, third stage
4 CONVEYOR BELT (horizontal)
5 CONVEYOR BELT (inclined)
Fresh water to shaking trough
6 SHAKING TROUGH
Sink product
Float product
Wash water to the washing screens
7 WASHING SCREENS (two)
Lump ore
Medium
Coarse tailing
8 CONVEYOR BELT
9 CONVEYOR BELT 16
10 LUMP ORE BIN
14 PUMP SUMP
15 MEDIUM PUMP
16 CONE THICKENER for medium
11 CONVEYOR BELT
12a CONVEYOR BELT 17
12b CONVEYOR BELT 18
13 To macadam mill and coarse tailing pile
Part of overflow as spray water to the shaking table division
Overflow
Medium

LEGEND

Crushing and grinding division:

1. Ore bin, 300 ton
2. Arboga Mek Verkstad Ross chain feeder, size 7D
3. Morgardshammars No. 6 jaw crusher, 150 tph capacity, 225 rpm, 67.5 kw, setting about 150 mm
4. Nyhammars Bruk reciprocating feeder, 700x1500 mm
5. Morgardshammar vibrating screen, 2.3 kw, 100x200 mm
6. No. 1 conveyor belt, 18 kw, 700 mm
7. No. 2 conveyor belt, 2.1 kw, 750 mm
8. Symons cone crusher, standard, 4 ft, 120 tph, 92 kw
9. No. 10 conveyor belt, 8 kw, 600 mm
10. Morgardshammar vibrating control screen, 100x200 mm, 2.3 kw
11. Conveyor belt No. 12, 8 kw, 600 mm
12. Conveyor belt No. 15, 8 kw, 600 mm
13. Broderna Envall, Fellingsboro vibrating screen, 5.5 kw, 280x120 mm

Sink and float separation division:

1. Bin, 350 tons of raw ore
2. Jeffrey-Traylor feeder
3. Allis-Chalmers Low-Head washing screen 4x10 ft, 5 hp
4. Belt conveyor, 600 mm
5. Same
6. Kopparbergs Verkstader shaking trough, 100x150 mm, 85 tph, 28 kw
7. Allis Chalmers Low-Head washing screen, 4x10 ft, 5 hp
8. Belt conveyor, 600 mm
9. Belt conveyor No. 16, 600 mm, 3.7 kw
10. Lump ore bin
11. Belt conveyor, 600 mm
12a. Belt conveyor No. 17, 500 mm, 3.7 kw
12b. Belt conveyor No. 17, 500 mm, 2.2 kw
13. Macadam mill and coarse tailings pile
14. Pump sump for medium
15. Landsverk PG-25-425 medium pump, 100 hp
16. Cone thickener 6 m dia, 60 cubic m

Results—The ore is hoisted to the 300-ton bin in the headframe as shown on the flowsheet and begins the concentration steps. Only the Stripa Process section is shown here; the jig and table plant being quite large. Production at Stripa Mining Co. is about 155,000 tons of sorted lump and 30,000 tons of fine concentrate a year. The mine is located at Guldsmedshyttan in the Province of Orebro, Sweden. Lump ore is transported from the mill by wagon on a track resting on high concrete pillars over the stockpile area. Wagons, which take a 3- to 3.5-ton load, are loaded from bins in the mill and hoisted up an inclined track to the level roadway. Each train is made up of seven cars and the wagons are unloaded automatically. Stockpile ore goes by incline to the railroad station.

Fine ore is transported by conveyor to a stockpile, and then by incline to the rail yard at Guldsmedshyttan.—Source Gote Eriksson's "The Stripa Process of Sink-Float Separation," Canadian Vickers' release, and *Swedish Mineral Dressing Mills*, compiled by Ernst Rothelius for the International Mineral Dressing Congress (Stockholm 1957).

Research Problem—To develop a new approach to the leach recovery of metals such as copper, molybdenum and zinc from their sulphide or mixed sulphide-oxide ores. Kennecott Copper Corp.'s Stuart Zimmerley (director of research), Dean G. Wilson and John D. Prater investigated the possibility of using naturally occurring bacteria to put the metals in solution. The three solutions shown here are part of the six claims in a U.S. patent No. 2,829,964 which was granted to the authors in 1958.

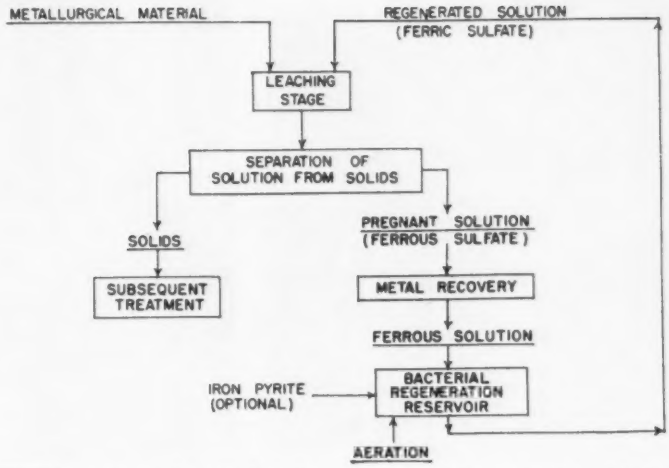
Results—Kennecott's process involves the use and continual regeneration of a ferric sulphate sulphuric acid lixiviant which has been inoculated with iron-oxidizing autotropic bacteria tolerant to relatively high concentrations of the particular metal or metals being sought.

For many years, waste water flowing from certain copper mines has been deliberately percolated and repercolated through waste ore dumps and even back through the worked out areas of the mine to leach out whatever copper values might be contained. Copper has been recovered by scrap iron precipitation. In some cases very low grade ore deposits have been leached in place in this manner, but, generally speaking, this procedure has been regarded as far too slow to be economic if any other method is applicable at the same time.

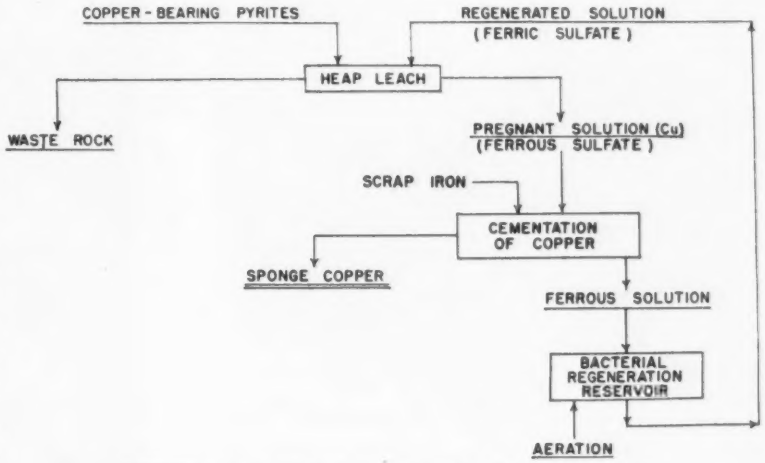
Ferric sulphate and sulphuric acid naturally present in the mine water is responsible for the solution of the copper. Ferric sulphate is also an effective lixiviant for a number of other metals. For example, metallic copper and iron are readily attacked by a ferric sulphate solution. Recovery of metal values from certain secondary or scrap materials, and upgrading of metallurgical products after a reducing roast are possible through ferric sulphate leaching.

Work has shown that the bacteria can act directly on pyrite to produce ferric sulphate and sulphuric acid. But, even more important, states the patent, is the exceptionally rapid manner in which the bacteria-carrying spent solution can be regenerated industrially by mere aeration without troublesome and expensive apparatus and procedures.—Source U.S. Patent No. 2,829,964 as abstracted with six flowsheets in E&MJ, June 1958, pp 89-91.

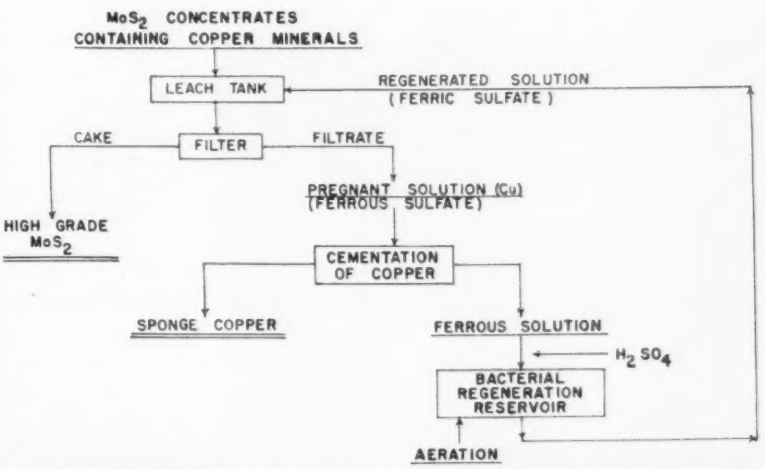
Solution—



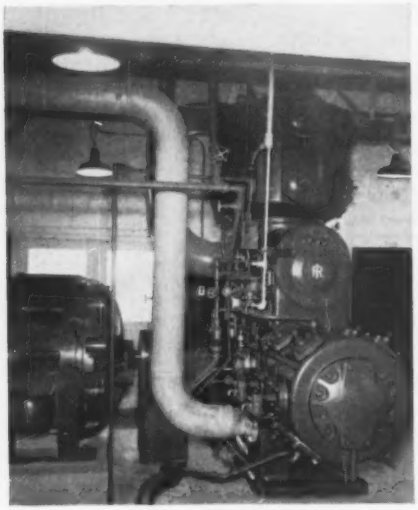
BACTERIA can be used to leach and recover a metal from almost any feed.



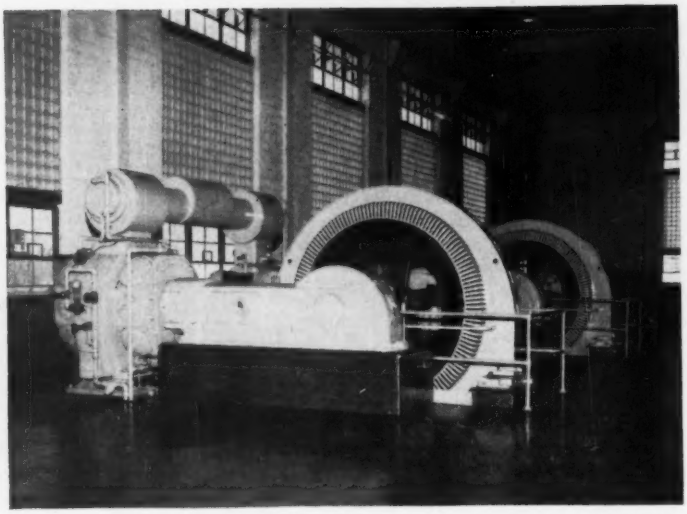
COPPER-bearing pyrite can be leached with ferric solution.



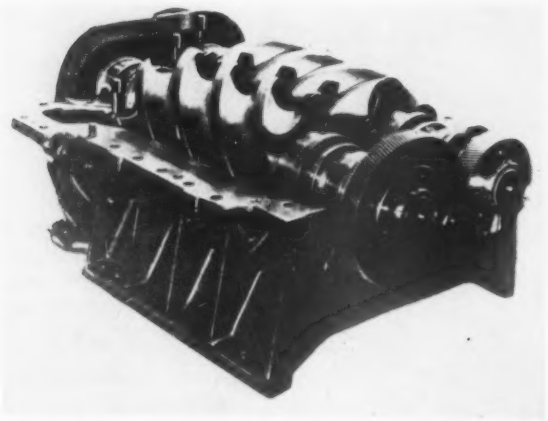
IRON-OXIDIZING bacteria can recover a molybdenite concentrate and copper.



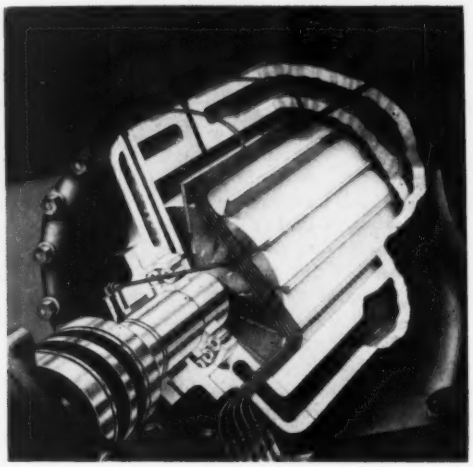
L-TYPE air compressor in eastern nonmetallic mine is powered by 250-hp motor. I-R Type XLE.



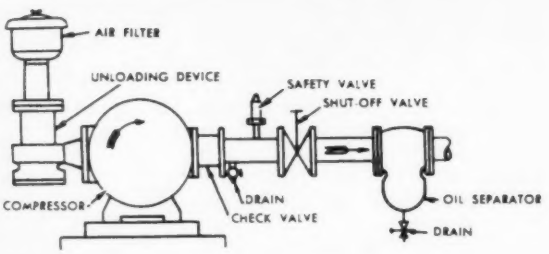
RECENT INSTALLATION of two 60-hp compressors capable of delivering 3,190 cfm of 100-psi air to underground equipment at Michigan iron mine. Ingersoll-Rand Type PRE units.



TWO-STAGE, positive replacement compressor develops four compression cycles per unit. Atlas-Copco design.

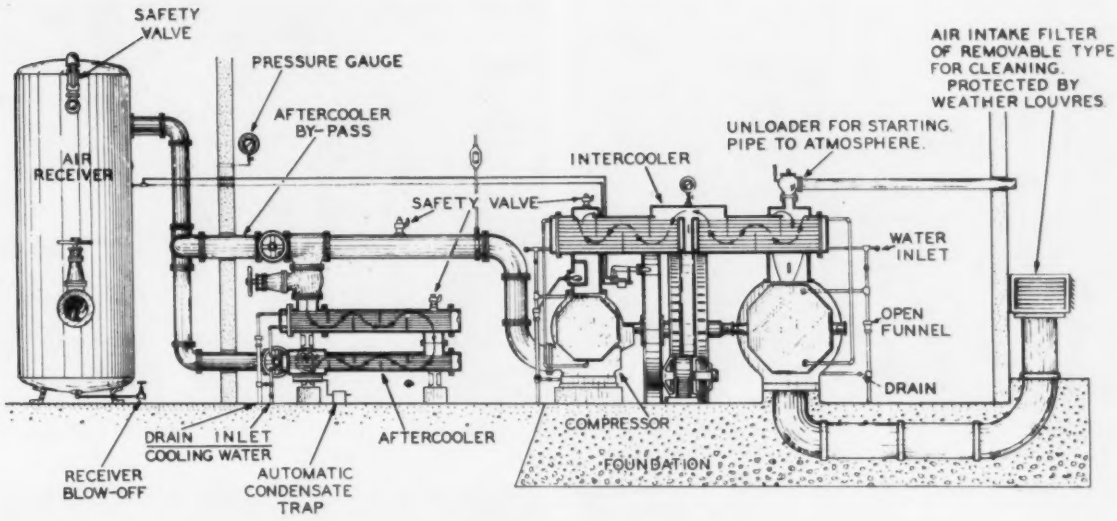


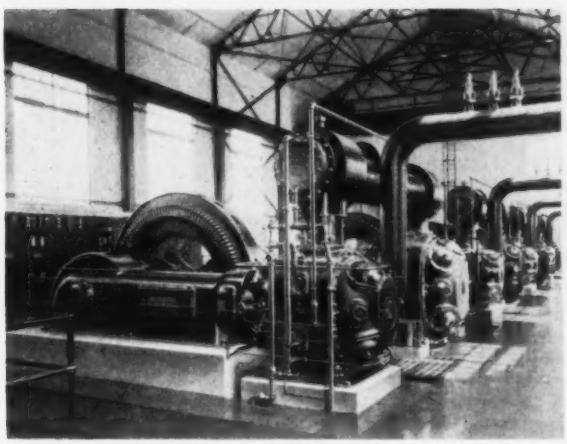
SEMI-RADIAL COMPRESSOR is driven by diesel engine. Unit is equipped with 14-V-belt drive. Joy-Caterpillar set.

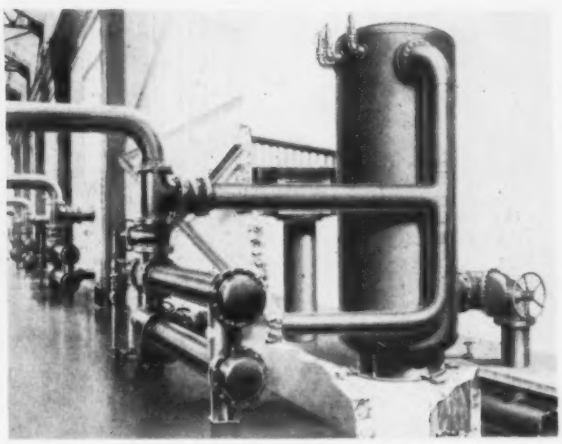


Vane-Type Rotary Compressor

ILLUSTRATION ABOVE shows vane construction of two-stage rotary compressor developed by Allis-Chalmers. Applications include compressed air or vacuum source for mills, processing plants, portable drill rigs, open-pit and underground mines. Drawing above shows appliances attached to compressor in a typical installation including valves, filter, drains and unloading device.





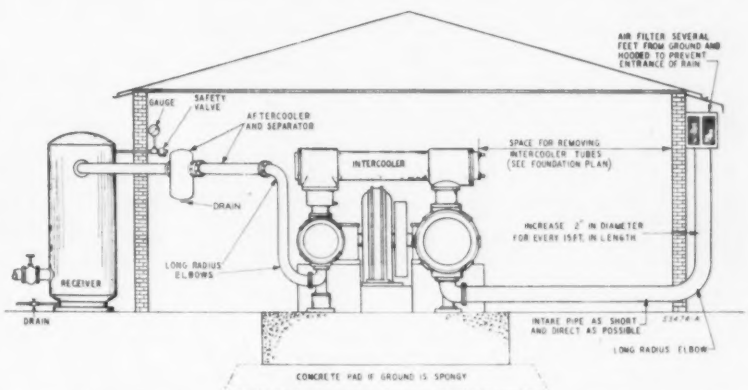


ESSENTIAL ELEMENTS of a modern compressed air plant appear in diagram above. Photo, lower left, shows compressors, intercoolers for 700-hp installations. Aftercoolers and air receivers shown at right. Ingersoll-Rand PRE installation.

Compressor Trends

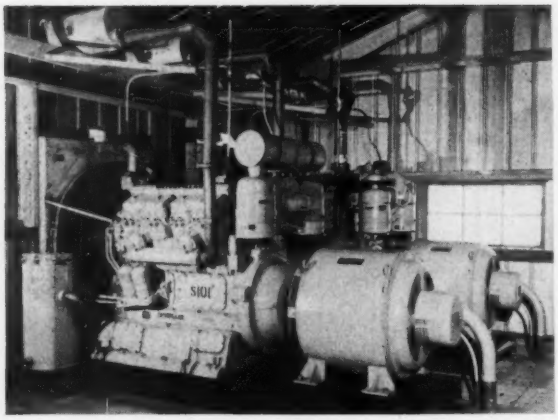
SIX BASIC compressor designs were described and illustrated in the last Guidebook review of compressor design, Mid-June 1957: Reciprocating two-lobe rotary, liquid-piston rotary, sliding-vane rotary, centrifugal and axial flow. A seventh type, the rotary-screw air compressor illustrated on opposite page, has been developed by Atlas Copco, and is now in operation at the Kiruna iron ore mine in Lapland. Two-stage rotary compressors have been designed with capacities of 6,700, 10,000 and 19,250 cfm at 120 psi when driven by 3,600 rpm motors.

More manufacturers are showing interest in rotary units of the two-stage type because of the advantages they offer in compact design and low-cost mantenance. But as shown in the recent installations illustrated here, the long-standing, rugged dependable designs are widely used. Model plants shown above courtesy Ingersoll-Rand Co.

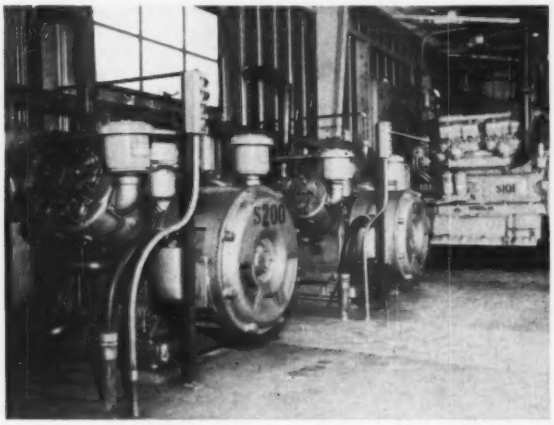

AIR FILTER SEVERAL FEET FROM GROUND AND HOODED TO PREVENT ENTRANCE OF RAIN
GAUGE
SAFETY VALVE
AFTERCOOLER AND SEPARATOR
INTERCOOLER
SPACE FOR REMOVING INTERCOOLER TUBES (SEE FOUNDATION PLAN)
DRAIN
INCREASE 2" IN DIAMETER FOR EVERY 15FT. IN LENGTH
LONG RADIUS ELBOWS
RECEIVER
DRAIN
INTAKE PIPE AS SHORT AND DIRECT AS POSSIBLE
LONG RADIUS ELBOW
CONCRETE PAD IF GROUND IS SPONGY

ELEMENTS of a model small compressor plant including filter and coolers.

KERMAC NUCLEAR FUELS operation in New Mexico is powered by diesel equipment. Output is 600 tpd.



TWO V-8 diesel engines drive 312 kva, 220/440-v generators supplying power for fans, shaft and lights.



DIESEL-ELECTRIC POWER is supplied to two Gardner-Denver, V-type compressors installed in power house.

POWER PRODUCED by diesel-electric units is controlled and distributed through this 440-v switchgear panel.

Diesel Power For Small Mines

DURING EARLY DEVELOPMENT and often throughout the life of a small mine, diesel units may power the entire operation, above ground and below, as shown in the photos of Kerr-McGee operations in New Mexico. Photos for this model diesel-powered small mine, courtesy Caterpillar Tractor Co.

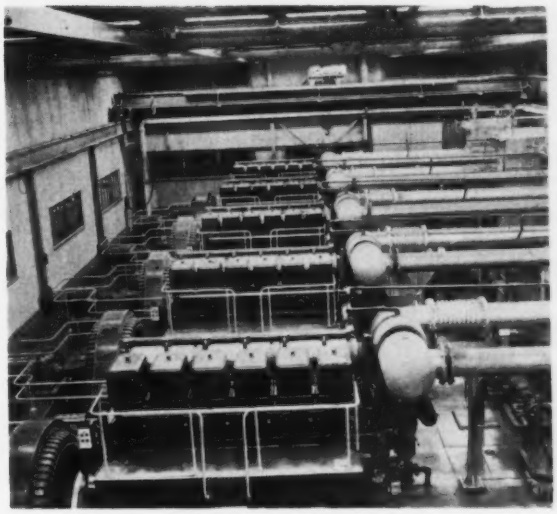
Portable Diesel Power Plant

THIS IS ONE of a number of portable diesel-electric plants moved from shaft to shaft during sinking operations on the Kerr-McKee properties in New Mexico. Caterpillar D397 unit powers a 112-hp hoist, 75-hp compressor, lights and other equipment. Final depth of shaft was 828 ft.

Diesel Power for Remote Operations

POWER for the 1,250-tpd uranium concentrator and surface plant of Gunnar Mines, Ltd., Saskatchewan is supplied by a 5,070-kw diesel electric plant designed for year-round operation. Six Nordberg 1,200-hp diesel engines operating at 450 rpm are direct-water power and diesel power connected to English Electric, 2300-V, 60-cycle generators rated at 845 kw.

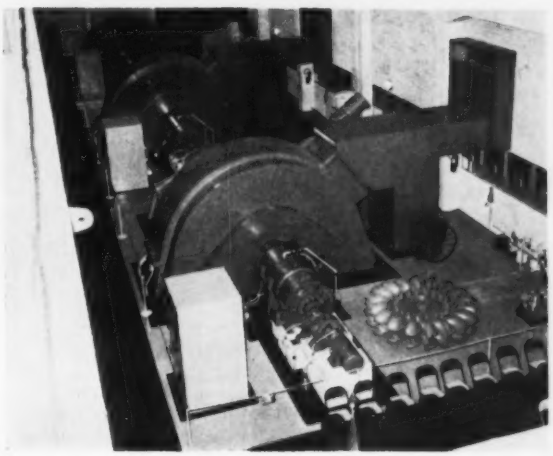
Generators	English Electric Co. of Canada
Governors	Woodward Governor Co.
Turbochargers	DeLaval Steam Turbine Co.
Fuel transfer pumps	Haight Pump Co.
Fuel filters	Winslow Engineering Co.
Fuel oil heaters	Kewanee-Ross Corp.
Fuel injection pumps	Scintilla Div.—Bendix Aviation
Lube purifiers	Winslow Engineering Co.
Lube oil pumps	Geo. D. Roper Corp.
Lube coolers	Kewanee-Ross Corp.
Jacket water pumps	Weinman Pump Mfg. Co.
Intake air filters	American Air Filter Co., Inc.
Air compressors	Quincy Compressor Co.
Air intercoolers	Young Radiator Co.
Exciter	English Electric Co.
Switchboard	English Electric Co.
Pyrometer	Illinois Testing Labs., Inc.
Alarm system	Viking Instruments, Inc.
Switchgear	English Electric Co.



YEAR-ROUND POWER is supplied to Gunnar property by six 1,200-hp Nordberg diesel engines developing 5,070 kw.

Water Power for Cerro de Pasco

CERRO DE PASCO CORP'S $25-million hydroelectric power project on the Paucartambo River in Peru produces about 72,000 kva to supplement other sources of power required for the company's extensive mining and metallurgical operations. Water from the river is channeled from the dam and settling traps at Yuncan (above) through a 40,800-ft tunnel to the 3,800-penstock (upper right) which feeds three double-jet, 28,000-hp, impulse turbines operating at 450 rpm, under an effective hydraulic head of 1,580 ft (right). The power house and substation at Yaupi Bajo are constructed to permit expansion to 100,000 kva through the addition of a fourth generator if warranted. Power is transmitted over a 42-mile, three-wire aluminum line at 138,000 v.



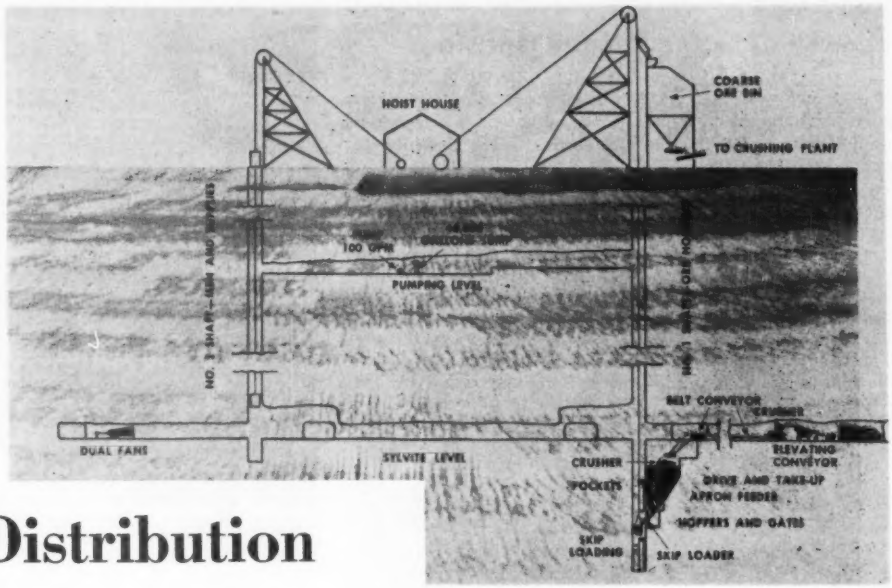


Fig. 1 Profile of a typical potash mine.

Power Distribution For a Modern Mine

POWER IS THE KEY to mechanization in mines and mineral processing plants designed to cut production costs. The accompanying diagrams and tables show the power distribution equipment, circuits and power centers required for an underground potash mine using modern electrical equipment.

In this idealized installation, a main substation is provided by the electric utility to transform incoming energy from 69 kv to 2400 or 4160 v. Power is distributed to the hoisting and processing equipment on the surface, and to underground mining equipment as specified in accompanying tables.

Continuity of service is of utmost importance, and circuits and equipment are selected to provide uninterrupted power for production.

The process of carrying multiple feeders into the mine is developing. Extension of the working faces several miles from the shaft calls for establishment of remote shafts for men and supplies. One or more "high lines" can be run from above ground to such a shaft or borehole, and a high-voltage cable can be run underground at that point.

Since continuity of service is critical, an emergency section of the main bus is established. This section is connected to the main bus during normal operation through a bus-tie circuit breaker. During main-bus power failure, the tie breaker is opened and the emergency bus section of the main bus is established from local auxiliary generating equipment. The emergency bus restores electrical energy quickly to at least one of the mine hoists, and such critical items as ventilation fans and pumping equipment. In certain ore-processing equipment, such as classifiers and thickeners, power outages can result in solidification of the material in process, requiring costly "digging out" procedures. Such loads are also placed on the emergency bus.

Energy received from the power plant bus is transformed to 440 or 220 v for motor-driven machinery. Transformation is performed by unitized combinations of high-voltage breakers or switching equipment, trans-

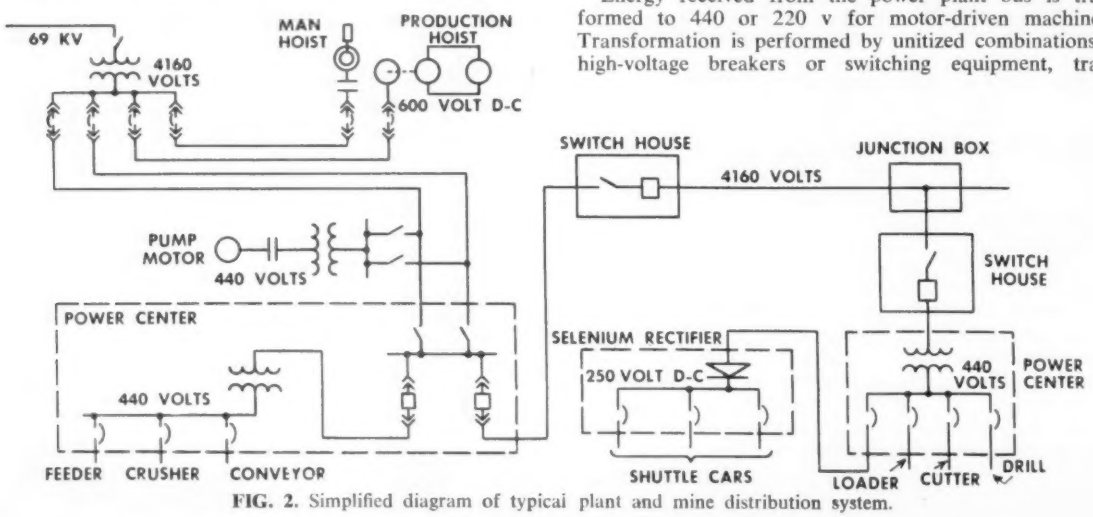


FIG. 2. Simplified diagram of typical plant and mine distribution system.

Table I — Typical Face Equipment Drives

Machine	Horsepower	MotorType	Control
Drill (Jumbo)			
Drive	26	Squirrel cage NEMA B	Full voltage start
Fan	0.75	Squirrel cage NEMA B	Full voltage start
Cutter	50–75	Squirrel cage NEMA C	Full voltage start
Loader			
Drive	50	Squirrel cage NEMA D	Full voltage start
Pump	6	Squirrel cage NEMA B	Full voltage start
Shuttle Car			
Traction	Two 10	DC series	Series start — parallel run. Dynamic brkg.
Conveyor Hyd. pump	10	DC compound	Full voltage
Continuous miner			
Cutter motor	Two 65	Squirrel cage SPCL	Full voltage start
Hyd. pump	10	Squirrel cage NEMA B	Full voltage start
Conveyor	Two 3	Squirrel cage SPCL	Full voltage start
Tramming	Two 7.5	Squirrel cage SPCL	Full voltage start

Table II
Typical Refinery Equipment Drives

Crusher	75–125	Squirrel cage NEMA C	Full voltage start
Rod mill	150–250	Synchronous wound rotor	Full or reduced voltage start secondary resistance starting
Classifier	15	Squirrel cage NEMA B	Full voltage start
Flotation cells	5–7.5	Squirrel cage NEMA B	Full voltage start
Conveyors	3–75	Squirrel cage NEMA B or C	Full voltage start
Kiln	15–40	Squirrel cage NEMA C DC compound	Full voltage start adjustable voltage

formers, and low-voltage switchgear for distribution of energy at utilization voltage to multiple feeders.

High-voltage protection consists of either high-voltage circuit breakers, fused or unfused load-break disconnect switches, fused or unfused magnetizing current-break switches, or a combination of both. Switches are mounted in a cubicle integral with the power center, circuit breakers in matching cubicles.

Formerly power was transmitted down the mine shaft at 2300 v and transformed for underground equipment to 240 v. But today, with the load centers far removed from the shaft, power distribution takes place underground at 4,160 v. The introduction of higher powered face equipment, such as continuous miners, has required an increase in working face voltages. At present, 440 v results in cables of smaller sizes, reduces power losses, and improves voltage regulation at the machines.

Underground power centers are designed to withstand physical abuse in working areas, to have adequate ventilation in confined spaces, and with appropriate dimensions for lowering units through the shaft. The low height of some deposits requires the design of compact equipment.

Power distribution for mine and plant.

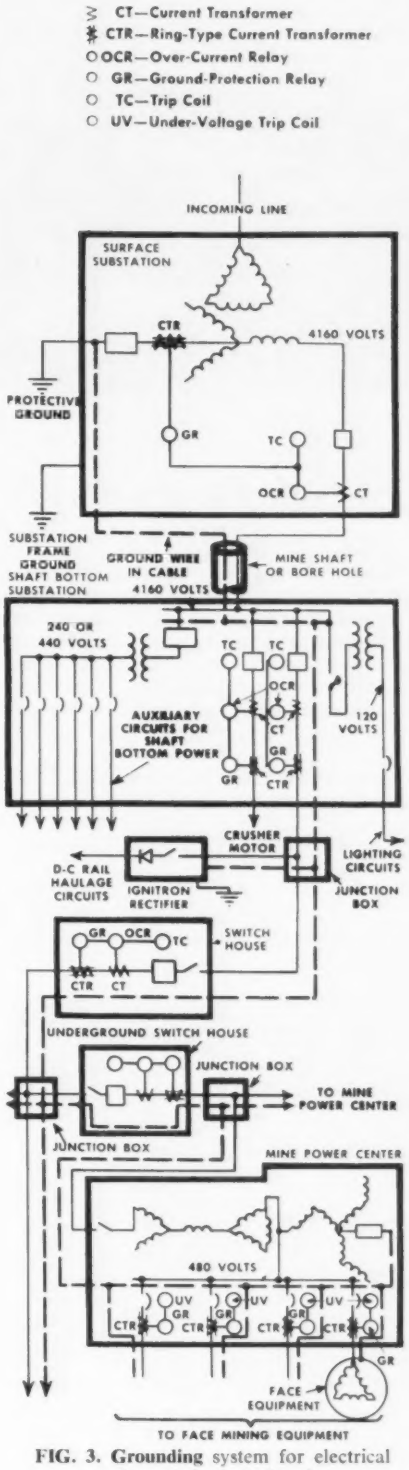
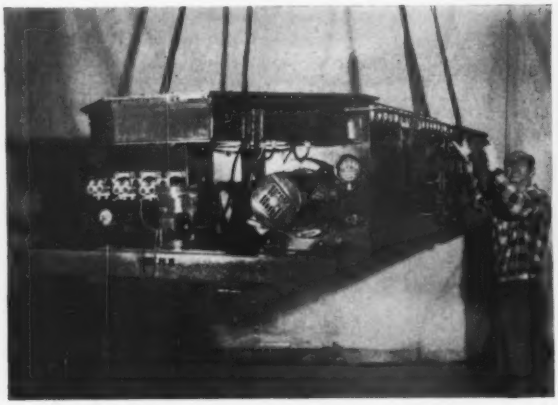
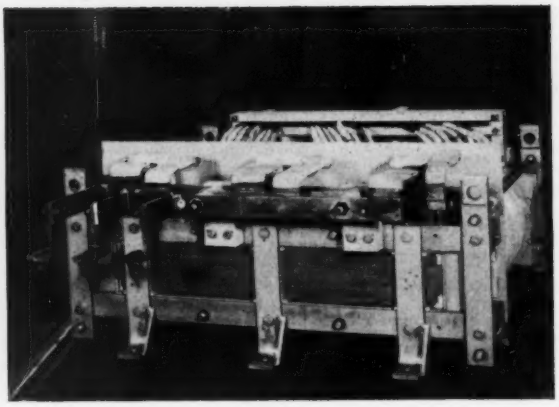


FIG. 3. Grounding system for electrical equipment in potash mine.

References: Excerpted from articles in *Westinghouse Engineer* and in *Pit and Quarry*, by B. E. Rector and C. B. Risler, Industrial Engineering Dept., Westinghouse Electric Corp., East Pittsburgh, Pa.



TRANSFORMER CAR for new portable silicon rectifier equipment is only 30 in. high. Ratings are from 300 to 750 kw.



TRANSFORMER is of the sealed dry-type construction. Sulphur hexafluoride cools unit through a heat exchanger.

New Portable Silicon Rectifier

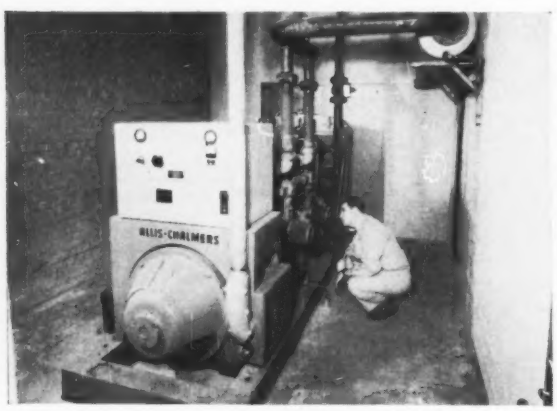
A NEW PORTABLE silicone rectifier that provides more economical dc power for nonmetallic and coal mines has been developed by General Electric Co. The equipment is only 30 in. high, and consists of a rectifier car and a transformer car. Called the "Lo-Boy" silicon rectifier, the units are available in ratings from 300 to 750 kw, 275 to 550 v dc, and are designed to withstand 150% of rated current for two hours, or 200% of rated current for one minute. The units operate at 95% efficiency at 95% power factor.

For maximum safety, all live parts are enclosed by grounded metal covers or screens. The completely static units have no moving parts except the cooling fans. Hinged doors and removable covers are provided for easy inspection and maintenance.

The transformer used with the silicon rectifier unit is of the sealed dry-type construction and uses sulphur hexafluoride (SF_6) as a cooling medium through an air-to-air heat exchanger. A fused air interrupter switch that provides 100,000 amp interrupting capacity and disconnects the rectifier in event of a transformer fault is mounted on the transformer car.

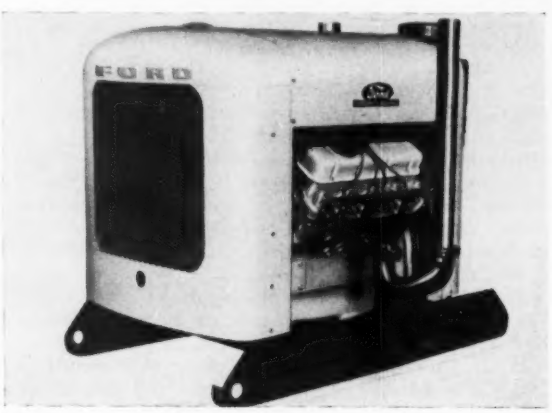
The silicon rectifier car contains silicon diode compartments, cooling fans and dc switchgear consisting of automatic reclosing equipment, line disconnect and a dc generator. The rectifier section contains three compartments where silicon diodes, diode fuses, fuse monitor and fan assembly are mounted.

The purpose of the fuse monitor is to indicate the presence of a faulty string of silicon diode rectifiers. If both diodes in one string fail to block, a short circuit is imposed on the rectifier transformer secondary. The resulting current blows the isolating fuse in series with the diodes. This fuse blows in less than one cycle, limiting the fault current and preventing damage to good diodes in other phases. Both units can be lowered in a shaft by cables attached to car bumpers.



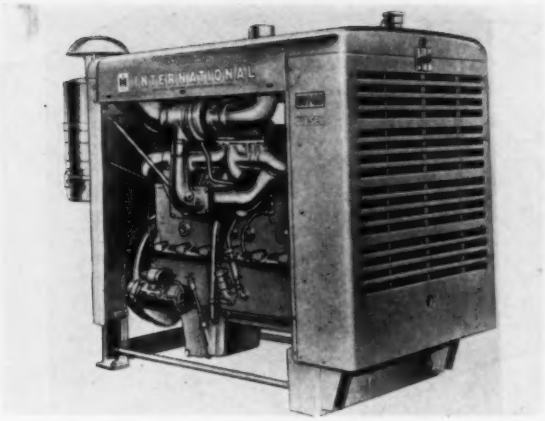
Standby Power for the Plant

A NEW LINE of standard 5- to 300-kw engine generator sets has been introduced by Allis-Chalmers Mfg. Co. Ac or dc sets are available in single or three-phase, 50 or 60-cycle frequency. Drives are diesel, gasoline, butane or natural gas engines. The unit above is a 100-kw diesel driven standby generator set.



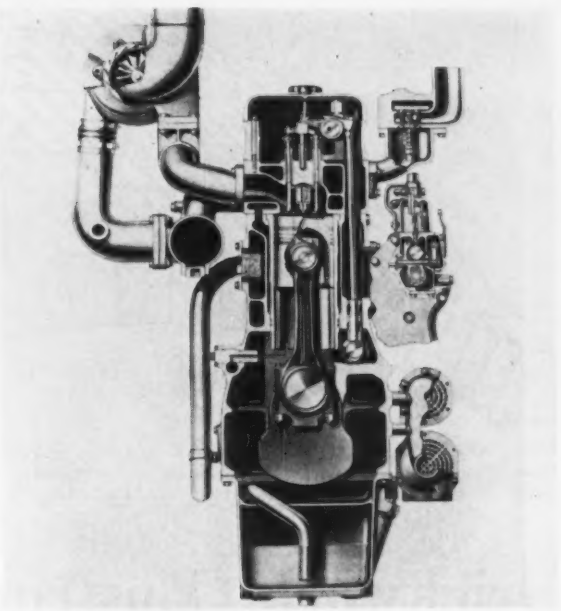
New Industrial Engines

FOUR NEW POWER UNITS to supplement gasoline and diesel industrial engines have been announced by Ford Motor Co. The power unit shown above is the 534-cu in., V-8 gasoline engine. Other new units include the 330 cu in. diesel, and the 401 and 477 cu in. V-8 gasoline engines.



New Turbo-Charged High-Power Engine

A NEW TURBO CHARGED DIESEL engine rated at 385 maximum horsepower at 2100 rpm is now in production at International Harvester Co. The engine is a six-cylinder, four-cycle unit, with 5⅜-in. bore, and 6-in. stroke. Features of the engine shown above and at right include direct injection of fuel at pressures up to 20,000 psi, dual intake and exhaust valves and aluminum alloy pistons. Model shown is UDT-817.



CUT-AWAY model of UDT-817 unit reveals aluminum alloy pistons working in replaceable wet cylinder sleeves.

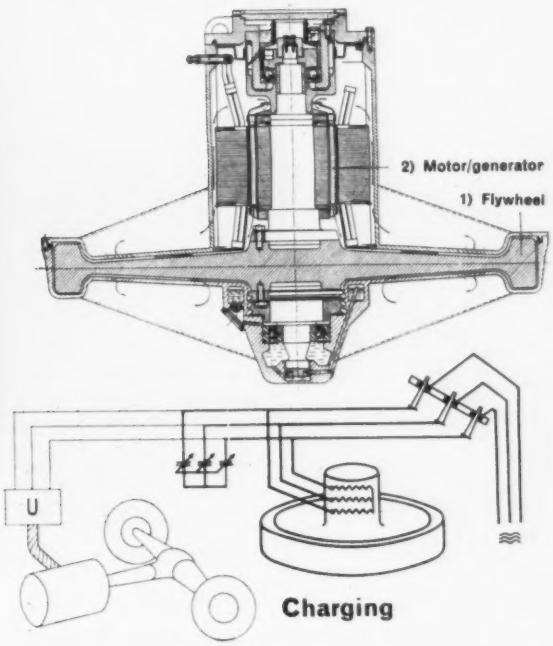
GYRO MINING LOCOMOTIVE pulls a string of ore cars in an underground ore mine in Switzerland.

Electrogyro—A New Power Concept

THE ELECTROGYRO mine locomotive illustrated above is being manufactured by Oerlikon Engineering Co., Zürich, Switzerland. Electric power for the traction motor on the locomotive is stored up as kinetic energy in a flywheel-generator. The same generator serves as an induction motor to charge the flywheel at the charging station.

A 100-hp Gyrotractor weighs 8½ tons (tractive effort is 3,500 lb) and is available in track gages from 24 to 37 in. The motor stores 3.5 kwh when starting with a flywheel speed of 3,000 rpm. Width of the unit is 53 in. and overall length is 11 ft 8 in.

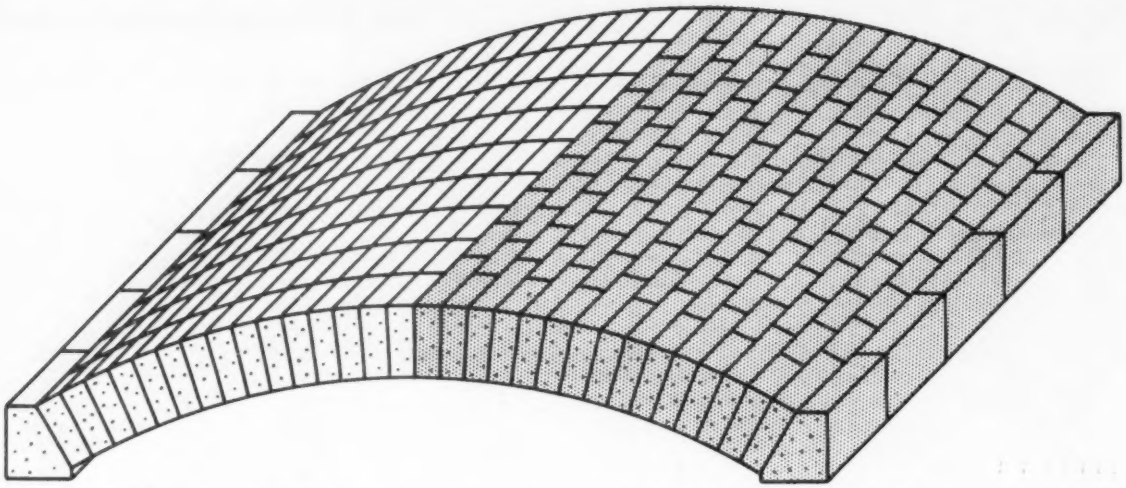
Oerlikon's first unit, called the Gyrobus, was a wheeled unit which went into service in 1953. Others were installed in Europe and South Africa.



MOTOR-GENERATOR is mounted on the flywheel, above. Electric energy is stored in the flywheel as kinetic.

The high-tensile strength flywheel has a 5 ft 4 in. dia., weighs 3,300 lb and can accumulate 24-million ft lb of energy at 3,000 rpm (approximately 9 kwh).

When the locomotive is stopped, the flywheel runs free in idle with very little loss of energy. Tests show that a fully charged flywheel running free will spin for 13 hr before coming to a stop. The locomotive can be braked electrically.



RING ARCHES are formed with either arch, wedge or key brick which have good spalling resistance and can be repaired easily. Structure has less longitudinal strain and is relatively easy to build. Bonded arches (shaded) are constructed with arch or wedge brick and staggered transverse joints to tie the construction together. Latter is good for hot repair.

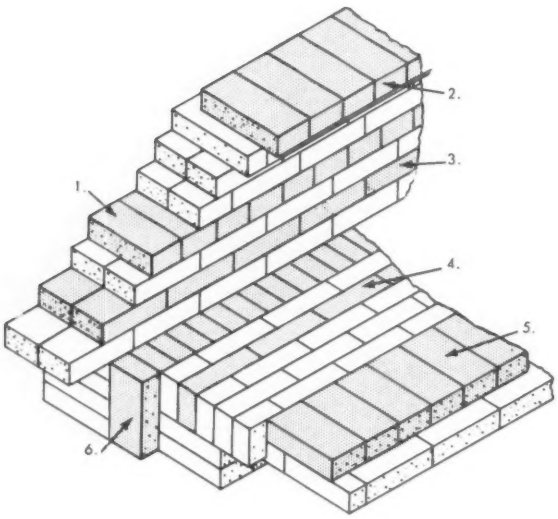
Brickwork Construction with Super Refractories

THE ART OF MAKING and using fire for productive ends is one of the distinctive achievements of mankind, ranking second only to agriculture in importance of man's existence. Besides providing warmth and other comforts in the home, fire is the basis of modern industrial life. It helps supply power necessary for manufacturing, transportation, lighting and heating. Its heat is used to convert the world's raw materials into products vital to our well-being.

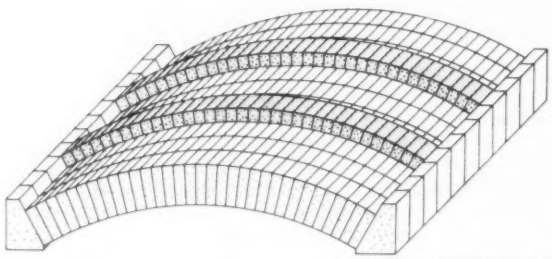
Although one of mankind's most useful tools, fire can be destructive and costly unless adequately controlled. Every year, uncontrolled fires ravage thousands of acres of timberland, destroy homes and factories, and take countless lives.

In industry, the use of fire entails important economic considerations which, besides fuel costs, include the cost of constructing and maintaining installations in which fires are contained. Furnaces, kilns and other equipment require construction materials that will withstand the effects of heat, flame erosion and other conditions created by the industrial use of fire.

The need for heat- and fire-resistant materials has led to the development of a class of products known as re-

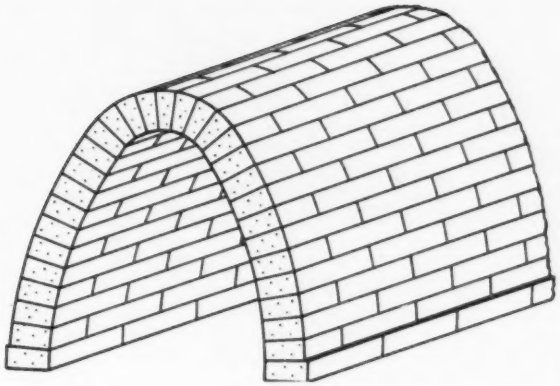


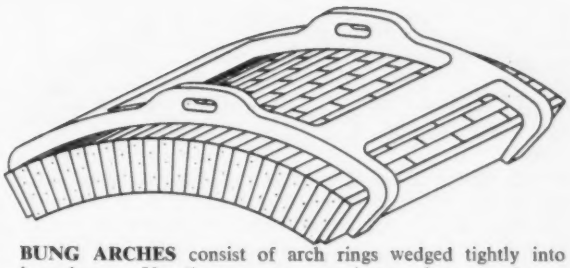
BASIC WAYS of laying brick are shown here. Order of the various courses does not represent an actual installation; only serving to indicate the kinds of construction most generally applied to furnace walls and bottoms. Headers (1) and stretchers (3) generally are used for walls proper, with header courses of soap or straight brick used to break vertical joints. Soldier (6) courses, in either wall or bottom, provide added thickness to withstand corrosion or wear for long periods of time. Rowlock (4) courses help carry superimposed loads on walls, bottoms and behind arch skewbacks. Corbel (2) construction in side walls narrows the width or diameter. Most work is with 2½-in. brick; 3-in. occasionally.



Redrawn from Refractories

RIBBED ARCHES are constructed of rings of different thickness to give stability over long spans. Thicker rings, called ribs, are separated by three or four thinner rings called valleys. Upper surface only is ribbed. Corrosion and abrasion resistance of this construction is very good.





BUNG ARCHES consist of arch rings wedged tightly into iron frames. Usually two or more rings make up a frame. Units rest on the furnace walls and can be replaced quickly.

INVERTED catenary arches, when properly designed and constructed, offer good stability as combustion chambers.

fractories. The first crude furnaces, built on a side of a hill to take advantage of winds, were constructed from earth and stones, usually mica shist or siliceous rock. At the present time, the majority of refractory brick and shapes are manufactured from, bauxite, kaolin and flint clays, silica materials, magnesite, lime, chromite, graphite and similar materials. They have a sufficiently high fusion point of resist normal heat conditions in low- and moderate-temperature installations.

Under particularly severe conditions where heat shock, corrosion and abrasion exist, the more commonly used refractory products are generally unable to provide the service life required for economical operation. Similarly, they lack the thermal conductivity, hot strength, density, spalling resistance and low permeability required in many operations. To meet these needs, the use of super refractories, made from electric furnace materials such as silicon carbide, alumina and mullite, is necessary.

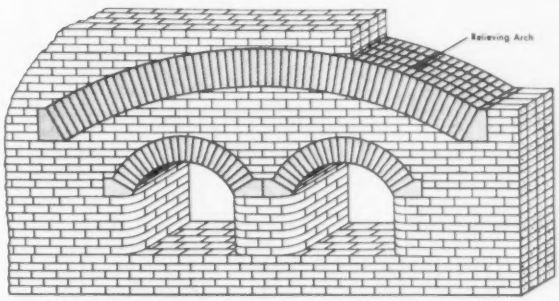
In the construction of furnace bottoms, walls and arches, super refractories are used by applying regular bricklaying techniques. The basic ways of laying brick are shown here in the next ten pages as abstracted from Carborundum Co.'s excellent bi-monthly bulletin *Refractories* through the courtesy of the Carborundum Co., Perth Amboy, N.J. Stretcher, header, rowlock, soldier, shiner and corbel courses offer distinct advantages in specific areas of construction. Their use is often determined by several factors.

The major purpose of furnace walls and bottoms is to effectively contain heat. In many instances, ability to resist abrasion and corrosion and to carry reasonable loads at elevated temperatures may also be significant factors. In all cases, it is important the refractory structure remain stable under even the most severe operating conditions and under prevailing heating and cooling cycles as well.

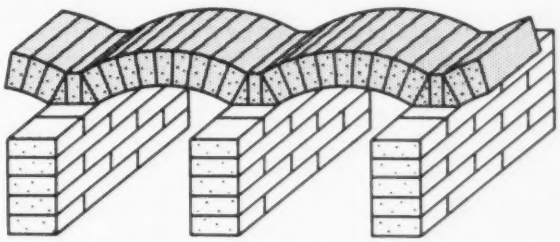
The most common wall construction is accomplished by laying stretcher courses of brick placed with their width at right angles and their length parallel to the wall face.

To insure stability of inner walls, brick are laid with their length at right angles to the wall face. Such courses are called headers and are usually placed after every fourth or fifth stretcher courses, depending on the height of the wall, to tie inner courses of brick into rear wall construction. Headers, of soap and large straight brick, are frequently laid so that vertical joints just below and above do not line up with stretcher course brick joints.

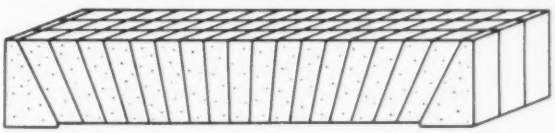
To back up a lining, shiner courses of brick are frequently used in wall construction, particularly where overall construction specifications prevent more than a 2½-in. thick backing. Brick length is placed vertically, with the width parallel and the thickness at right angles to the wall face.



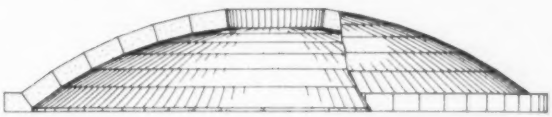
RELIEVING ARCHES are constructed in furnace walls above door and burner holes where periodic repair may be needed.



JACK ARCHES are built into walls or over piers and generally are narrow and shallow. Galloping arches are series of jack arches used to span piers. Skewbacks butt to fit.

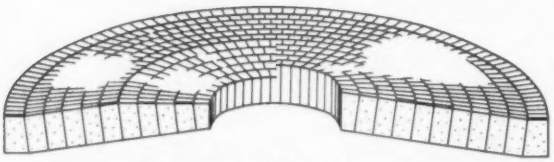


FLAT-BACK ARCHES are somewhat similar to jack arches and are sometimes referred to as flat-back jacks. Major difference is that the flat-back does not have a bottom radius.

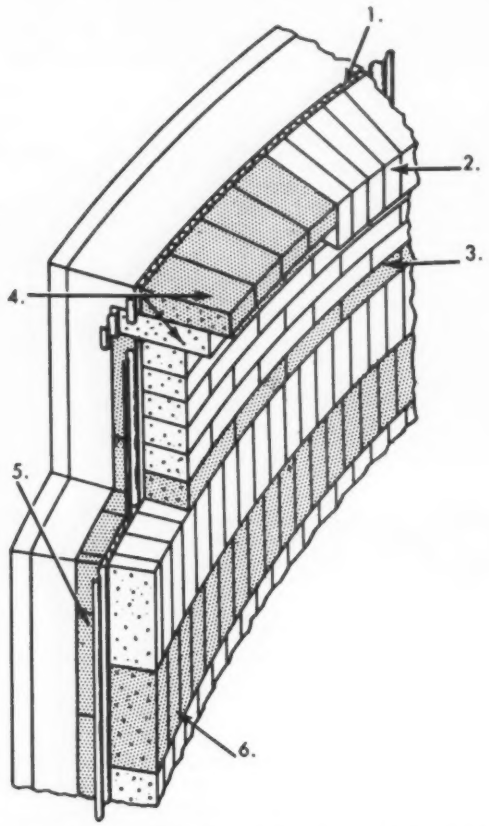


Redrawn from Refractories

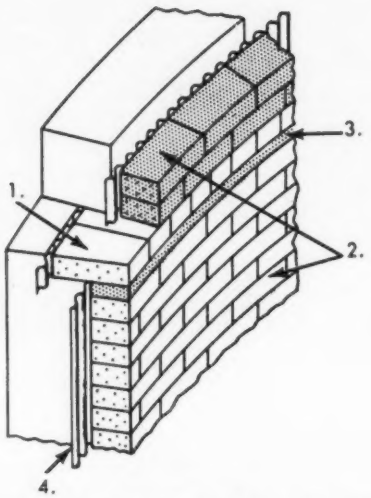
DOME ARCHES are spherical units constructed of circular rings of arch, wedge and straight brick supported by skews on the walls. Arch rise is usually 1⅝ in. per foot span.



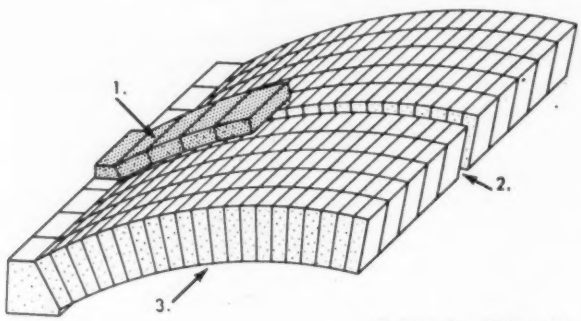
CONE ARCHES are circular units laid in rings of arch, wedge and straight brick, the length of a brick is at right angles to the top and bottom surface of the arch. Slope is 1¾ in. per foot of span. When used in multiple hearths, a portion of the furnace can be cut at 90 deg with the center line to form a flat horizontal hearth surface.



IN VERTICAL cylindrical structures, arch bricks are laid on soldier courses (6) and tied into rear brickwork by key bricks (4). Latter also serve to tie in circle brick (3). Shiner courses (5) of straight brick are used behind the inner course of brick. Expansion joint (1) and wedge brick rowlock (2) are shown.



IN CYLINDRICAL structures, all brickwork above the vertical expansion joint (3) should be supported by key or wedge brick headers (1) over the joint. Circle brick (2) and cardboard expansion joint (4) also are shown on drawing.



Redrawn from Refractories

TO ALLOW for arch expansion, slots should be provided in several spots. Expansion joints (2) can be covered with brick (1) or packed with ceramic fiber. No. 3 is wedge brick.

Where greater strength to carry superimposed loads is required, rowlock courses of brick are used to change the height of courses, for sills and for the bottom or floor construction. The length of brick is laid horizontally, extending back into the furnace wall, with the width placed vertically. Such courses are also used as headers in wall construction and as back-up members behind arch skews.

In furnaces melting erosive or corrosive materials, soldiers courses are generally used in bottom construction. The brick length is set vertically with the width perpendicular to the wall face, providing added depth for longer bottom life. Arch brick, when used in vertical construction, are usually laid in soldier courses. Such courses are not particularly stable and are not recommended to carry loads. As a means of narrowing the interior width of the furnace, corbel construction is used in the side walls. Each course projects beyond the one immediately below it. If an arch is to be thrown, corbelling furnishes the necessary support.

A variety of arches can be constructed from super refractory brick to meet both standard and special requirements.

Furnace coverings or roofs usually take the form of a sprung or a suspended arch. The former is supported at the sides or ends and consists of a segment of a circular ring. The line of contact between the under surface of the arch and its support is called the spring line. Suspended arches consist of brick held in place by metal supports suspended from overhead framework.

Spring arches are constructed from arch, wedge and key brick supported at each end by skew brick. The latter are supported, in turn, by the furnace wall. The slope of the inner face of the skew brick is determined by the included angle of the arch span. Ideally, the radius on an arch should equal the arch span, resulting in an included angle of 60 deg. In this case, standard feather edge brick,

with a slope of 60 deg, serve as skews in the construction.

The thickness or depth of an arch depends on its span as well as the kind of service anticipated. In general, however, an arch with a span of up to 48 in., will require a 4½-in. thickness. Spans of from 4 to 15 ft are constructed with a thickness of 9 in., using wedge or key brick. For spans above 15 ft, a 12 to 13½-in. thickness is recommended, and the use of wedge brick is preferred.

All thicknesses referring to the main furnace roof do not include courses of insulating brick that may be laid on top of the arch.

In allowing for arch thrust, it is important to back up the skew brick with a load-bearing brick construction carried out to the steel supporting member located on the furnace shell. Of the various methods of constructing sprung arches the most widely used are shown on pp 256 and 257.

When high temperatures are encountered, thermal movement in a sprung arch frequently takes place and the arch tends to take the form of a catenary. If the arch is initially designed along the catenary line at its center of thickness, less distortion will occur in service. Some furnaces are constructed with a catenary arch starting at or near the floor, forming the sides and roof of the furnace. Such a free-standing arch does not require any side steel framing. Special purpose arches, such as relieving, jack and flat back arches, are constructed to meet specific installation requirements. Relieving arches support the weight of upper walls which are undisturbed when other sections of the furnace lining are required.

Jack arches usually have narrow spans and are not too deep. When a series of these arches span piers, for example, they are called galloping arches. Flat back arches have flat bottoms and are without a radius. They are used where space is at a premium.

Circular arches, such as dome and cone arches, find application in muriatic acid furnaces and in multiple hearth furnaces. The dome arch is spherical, and is built of rings using arch, wedge and straight brick, and usually has a rise of 1⅝-in. per ft of span. In the cone arch, the bottom is designed to a slope of 1¾-in. in 12 in. Arch and straight brick are laid in rings with their length at right angle to the bottom. Cone arches are subject to considerable abrasion, requiring the use of suitable wear-resistant brick.

Cylindrical structures, such as found in gas generators, air heaters, pebble heaters and many other types of units, are constructed from circle, wedge and key brick using a combination of arrangements. Several of the more common constructions are shown here.

In units subject to heating and cooling, it is important that expansion joints be provided in the brickwork of the bottom, side walls and arch. Joints should be staggered or broken so that they do not carry straight through the bottom of side walls. Sufficient joint allowances should be made at the corners of end and side walls.

Frequently, broken pieces of firebrick or cement may fall into the joints and render them ineffective. To prevent this, it is advisable to place cardboard or similar material in the joints during construction. The cardboard will burn out in the early stages of heating up the furnace. The joints can also be packed with resilient refractory packing such as Fiberfrax fiber.

In cylindrical vertical units, vertical and circumferential expansion should be accommodated by placing corrugated cardboard, ⅛-in. thick, in back of the inner course of brick, and packing joints in the inner brickwork with compressible refractory material for vertical expansion. Joints also should be provided in furnace ashes to allow for thermal expansion of the arch.

In laying super refractory brick, cements of similar compositions should be used. Brick should be dipped whenever possible, or, if that is not practical, should be laid with a very thin trowel buttered joint. For strong bonds over a wide temperature range, the use of air-setting cements often is recommended.

How to Allow For Expansion Due to Temperature Change

ALMOST EVERY MATERIAL ON EARTH expands when heated. In furnaces, muffles kilns and proces vessels that operate with temperature fluctuations, dimensional change usually poses a construction problem. It becomes acute with temperature variations in the hundreds or, even worse, thousands of degrees.

An appreciable temperature difference between the inside and the outside of a single structure also has to be considered.

Practically speaking, structures designed for high temperatures need more provision for expansion than those for more moderate temperatures. They need more expansion joints, sometimes larger joints between sections, and always constant vigilance to forestall the destructive effects of thermal expansion.

Expansion coefficients of various refractories differ markedly. Hence, this characteristic must be studied carefully in selecting one or more products for a specific installation. The information on this subject that follows is based on Carborundum's refractories only.

What Can Happen

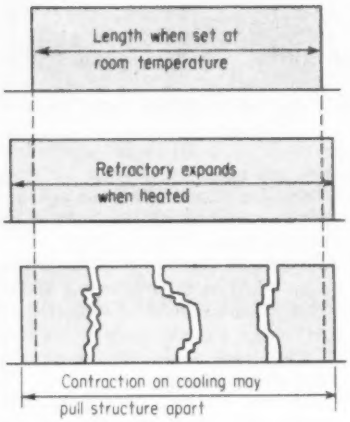
Service life and performance of refractory products are often limited or shortened unintentionally by failure to allow for thermal expansion of the structure—oversight can split a cylindrical steel casing or even distort a furnace setting. It can also result in spalling or local cracking of the refractory. At first inspection this might be interpreted as a misapplication of that product.

In other cases, thermal movement will open up cracks. Leakage of corrossive hot gases into backup masonry may result in destructive attack and an extensive repair job.

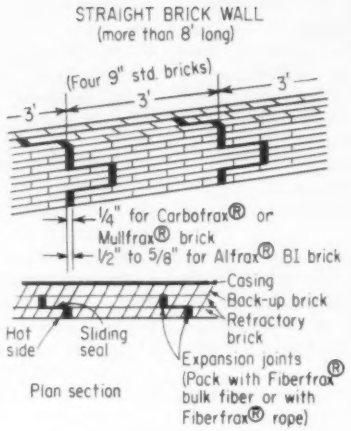
The examples sketched on these pages illustrate a few common types of failure that can be prevented by adequate allowance for thermal changes. Ways have to be devised to provide for expansion; entailing precautions both in design and in construction methods. In a furnace, the refractory parts may be hot on one side and cooler on the other. Concentrated hot spots on a relatively long structure may make it difficult to say what temperature to use for determining expansion.

In most cases, provisions for thermal expansion are not precise. When there is some doubt, it is always possible to allow a slightly larger joint or to space joints closer together.

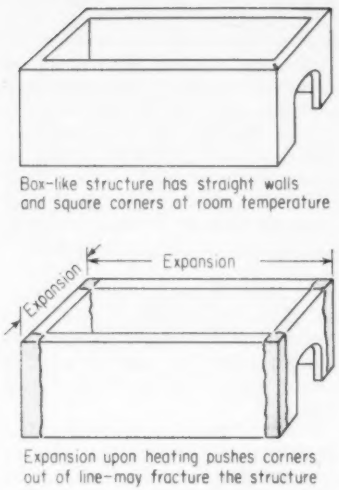
Practical problems often arise because of relative expansion of one part of a structure as compared with another part. If surfaces of both structures are heated and if the temperatures differ, then a theoretical analysis of the situation becomes ex-



REFRACTORIES expand and contract on heating and cooling. Structure may crack if changes are too sudden.



WALLS less than eight feet long need not be jointed. Longer walls need joints and refractory fiber packings.


Box-like structure has straight walls and square corners at room temperature
Expansion
Expansion
Expansion upon heating pushes corners out of line—may fracture the structure

EVEN a heavy steel frame bracing cannot resist or prevent distortion.

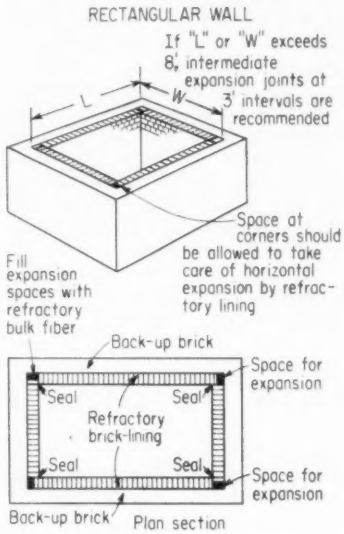
tremely complex. The geometry of the parts, conductivities, thermal masses and speed of heating will all be factors. The best guides for deciding how to handle this type of problem are simply good judgment combined with experience.

Examples shown on this page illustrate practices that experience has shown to be thoroughly practical and effective.

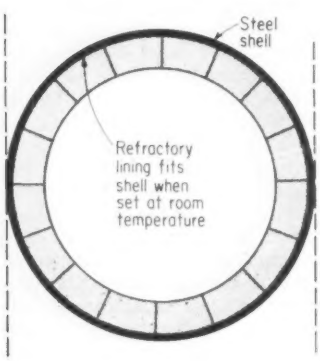
Even with proper allowances for expansion, it may be necessary in some refractory structures to provide for thermal movement of individual pieces. At the same time, a reasonably tight seal may be essential.

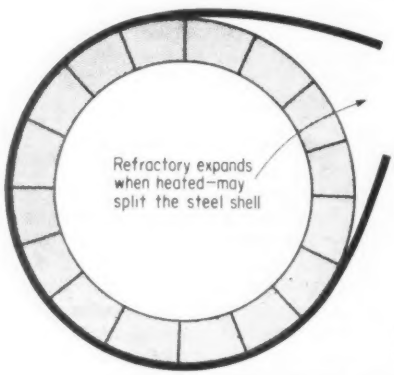
The examples presented on these pages show a number of places where expansion joints are left between refractory parts. To protect the structure against the harmful effects of leakage and to keep foreign materials out of the opening, a packing of refractory fiber such as Fiberfrax is recommended. It yields to the pressure and prevents damaging overloads. Ordinary corrugated cardboard is extensively used when expansion joints are provided.

If instructions are given to leave a ¼ or a ⅜-in. space between courses of refractory brick, it is difficult to be sure that a clean opening will actually exist by the time the unit is ready for service. If a layer—or several layers—of cardboard are placed between the courses, there is considerable assurance that expansion requirements will be met. It also may be placed between linings to obtain the expansion room needed. Cardboard is as practical as any of the materials that might be employed. It burns clear and leaves no objectionable ash or residue in the space.

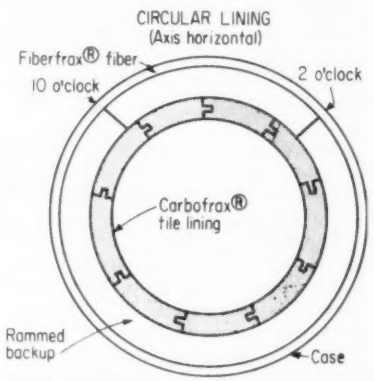


HERE'S how to allow for expansion at the corners of rectangular structures.

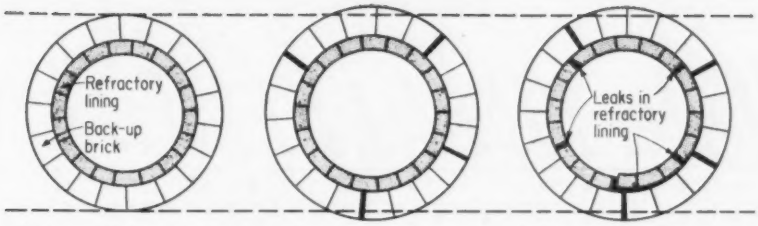




THE FORCES that an expanding refractory structure exerts can be tremendous, even to rupturing the outer shell.



THIS construction is used in packaged steam boiler fireboxes where the tile lining can expand and rise on top when heated.



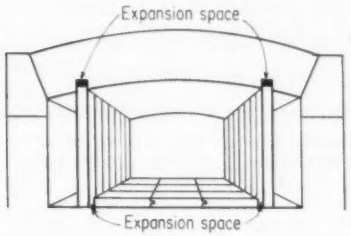
Lining and back-up brick fit well when set at room temperature

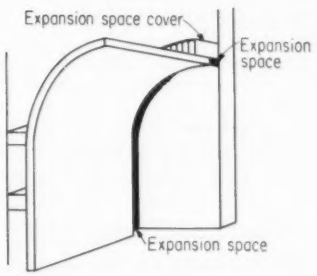
Heating expands refractory lining, back-up brick may crack slightly

Cooling and contraction of lining can open up leaks in the lining and lead to general failure

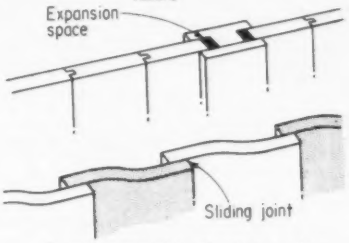
HOW LEAKS are produced—structure may fail later due to the leaks produced.

SIDEWALLS can have either expansion joints at barber points (above) or through shiplap construction (below).

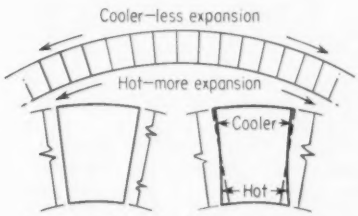




HORIZONTAL and vertical expansion must be provided for in some types of structure at end and side walls.



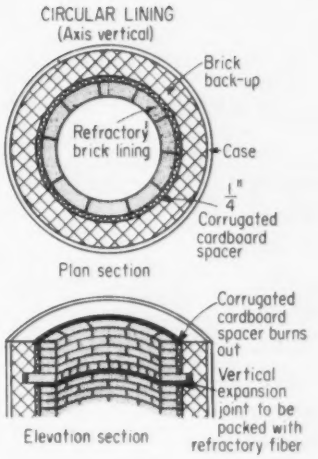
An arch made of a refractory similar to Alfrax BI brick, which is a relatively good insulator at high temperature, will heat up more on underside than on top



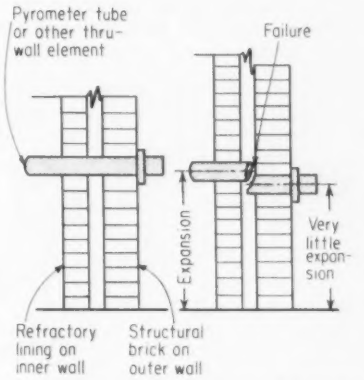
Close-up of well-fitted brick at room temperature

When heated, inner portion of brick carries entire arch load—may fail by crushing or spalling

EXAGGERATED sketch shows what happens to the arch during the changes in temperature that occur.



TO PREVENT dirt and cement from filling the expansion joint, use cardboard.



Redrawn from Refractories

THROUGH-WALL refractory elements can be damaged by expansion unless some freedom of movement is allowed.

Refractory Maintenance Tips

THE ROLE OF MAINTENANCE as a cost-control tool has been discussed at length in its applications to many types of industrial equipment. Electric motors, and control- and power-distribution systems have received their share of attention. Maintenance of machinery has been stressed again and again.

The reason why so much time and so many pages have been devoted to maintenance in so many industries is simply that it is a major area where operating costs can be cut. How well maintenance work is managed and performed will have a large bearing on over-all costs per unit of product turned out.

Special maintenance situations exist for the heating machines in industry—the kilns, furnaces, recuperators, reactors—that are constructed partly or wholly of high-temperature materials. They do not fall into the same pattern as machinery or electrical equipment.

For one thing, a rigid schedule of maintenance routines is either impractical or impossible to establish. Such easy-to-follow instructions as—"replace wearing rings after each thousand hours of operation and overhaul entire machine after 10,000 hours"—cannot be paralleled with equally specific rules for the care of refractory structures.

Even though they may demand more vigilance and more judgment to carry them out, there are nevertheless a number of refractory-maintenance guides that have proved extremely worth-while over the years which are presented on the following pages through the courtesy of Carborundum Co. Because refractories are premium priced, prudence demands enough maintenance, inspection and minor repair work to prevent needless failure of expensive structures—the "ounce of prevention" will return full value from the investment made in super-refractory materials.

Well designed, properly installed re-

LOCATION	CHECK FOR: Loose Brick or Blocks	Cracks	Expansion Joints	Slag	Spalling	Erosion or Corrosion	Broken Tile	Tightness	Leakage	Clearance	Sand etc.	Impingement	Dust or Dirt Accumulation	Warping or Bulging	Reglazing	
BOTTOM	•	•	•	•	•	•					•	•	•			
WALLS	•	•	•	•	•	•	•	•				•		•		
HEARTH		•	•	•			•	•	•			•		•	•	
ARCH	•	•	•	•	•	•			•	•		•	•	•	•	
MUFFLE		•	•			•		•	•	•		•		•	•	
FLUES	•			•							•		•			
DAMPERS	•	•	•	•	•		•	•		•			•			
STEEL SHELL								•						•		
TUNNEL KILNS	•	•	•	•	•	•	•	•	•	•	•	•	•	•		
KILN CARS	•	•	•		•		•			•	•					
BURNERS				•								•				
CONTINUOUS KILNS	•	•	•	•	•	•	•	•	•			•			•	

HERE IS a suggested check list for inspecting refractory structures. Thorough inspection can pay extra dividends in extended refractory life and over-all performance. How to correct situations found and operating hints are shown below.

fractory structures will serve for years with little or no repair work and with only routine inspections. These successes are not just fortunate accidents. They depend upon catching the small things—interpreting the danger signals —taking corrective actions before serious conditions occur.

What to Look For When Inspecting Refractory Structures

"Whenever you get the chance" is a good guide to frequency of inspecting refractory structures. That is — provided the interval between chances doesn't get too long.

Insides of kilns and furnaces should be examined routinely through peepholes, if necessary—perhaps every day and certainly every week. Bung arches should be lifted occasionally so that the condition of other parts of the furnace can be ascertained.

Operating conditions should be checked for changes in pressures, drafts, temperatures, or other measurable aspects of performance. By tracing down the cause of any abnormal condition, it is often possible to correct a condition that might otherwise result in costly repairs.

Air or flame leakage should be noted during routine inspection. It can be dangerous to let such obvious things go until, by habit, they are commonly accepted as normal conditions.

Observe all visible expansion joints. Exposed joints that were originally open or packed with refractory fiber may become jammed with broken particles of brick or cement. In some cases, they can be clogged with sand or other foreign material. Many times this can be detected with the unit in operation. Other times a closer inspection is necessary, but, in either case, the situation is a cause for concern and remedial action.

Cover tiles over expansion joints should be checked periodically to be sure that they slide freely, without binding.

Spring-loaded or weight-loaded mechanisms employed to assure tight joints in sectional muffles and retorts deserve a periodic inspection. Pivots and parts should be free to move, parts should be clean, and all linkworks should be functionally sound. The operation of the refractory structure depends upon the effectiveness of the equipment.

External steel supporting or binding structures should be checked for abnormal distortions. If they are out of line, this may give a clue to expansion-joint trouble affecting the material inside. Both horizontal and vertical alignment may be involved.

Slag and Other Accumulations

Build-up of slag should not be ignored. It can cause spalling and even chemical attack on the underlying brickwork.

Arches and horizontal tile that serve as heat transfer members should be checked for accumulations of foreign matter on the top surface. It sometimes acts as insulation to impede heat flow.

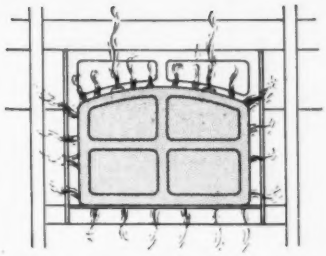
Flues require periodic inspection in those types of installations where sand or dust may fall or be blown into them. The wise operator will make sure that they are kept clean enough to deliver full air- or gas-flow capacity.

Cracks and Loose Brick

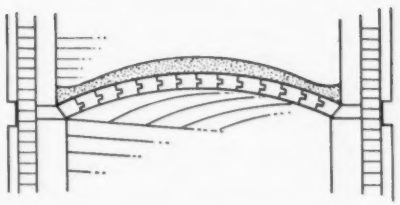
The beginning of deterioration in all parts of a refractory structure must be anticipated. By experience, it is possible to learn where the trouble spots are likely to be. However, every opportunity should be taken to examine all exposed areas for cracks, loose brick, broken tile, leaks, gaps in cement and similar evidences of physical breakdown, and to be sure that refractory dampers are in good shape. Checks on pyrometer tubes, ledge blocks, and other parts that have unsupported projections are necessary.

Spalling

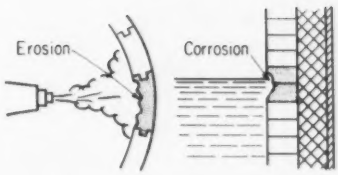
Sometimes spalling can be detected through peepholes while the structure is hot. Often, a detailed close-up examination is necessary. The places to watch for evidences of spalled surfaces are the areas where thermal shock—rapid changes of temperature —may be imposed on the structure during regular operating cycles. Also, the undersides of arches where pinching action may induce stress spalling



FLAME leaks may indicate blocked flues or other obstructions present.



DUST accumulating on heat-transfer arches creates loads, reduces transfer.



EROSION can occur where refractories are subject to high velocity blasts.

must be examined. Heavily-loaded structures of other types—with stresses imparted either by thermal or mechanical means—should also be kept under surveillance.

Erosion and Chemical Attack

Where hot gases may impinge on refractory elements at high velocities—for example, around burner ports—erosion may occur. Refractory materials can be eaten away by impingement erosion, by chemical attack or by a combination of both.

Molten materials handled in refractory structures may attack the walls chemically. Careful checks at the normal metal level and just above or below it will avoid trouble later.

Wear and Tear

The facility with which wear can be detected depends upon two factors—whether the equipment has observation ports and if temperature of any magnitude is involved.

A downcomer elbow is a case in point. Completely enclosed, hot spots on the shell are practically the only signs of lining cut-through. Thorough inspection should be made during shutdowns.

Most dust collectors are provided with doors through which checks can be made of the lining's condition. Conducted on a systematic basis, signs of severe wear can be spotted and necessary action taken.

In these and similar units, it is especially important to at least inspect those areas where dust-laden gases change direction, no matter how slightly.

Open conveyors, such as coke chutes, should be examined thoroughly at regular intervals, with replacement of those pieces that are in poor condition to extend over-all life.

Skid rail wear usually is noted by comparing relative heights of hearth and rails. If a single rail unit moves out of position, especially at a joint, it should be given immediate attention. When reaction with molten slag occurs, cover sides of rails with plastic chrome.

How to Correct the Situations That Inspections Reveal

The decisions you make about when to accomplish maintenance repairs are tied in, obviously, with production requirements.

Serious troubles require prompt correction. Even though production is interrupted, it may be necessary to fix certain things in order to protect an entire unit. The structural soundness of an arch, for example, may be impaired.

Minor damage noted during inspections can often be allowed to wait for a more convenient time before repair work.

Maintenance Clean-up Jobs

Routine housekeeping makes an important contribution to refractory life. It should be done thoroughly. Also, clean-up work often reveals needed repairs where an undesirable situation had been concealed.

Dust, dirt, scale and sand accumulations should be removed from floors, flues, tops of arches, crevices—wherever they are found. Many high-temperature processes create their own characteristic type of debris—depending upon the operation and the nature of the process materials involved. Its removal is usually the first maintenance step.

Slag accumulations should be chipped off. Where slag buildup is extensive, the use of pneumatic tools is usually advantageous.

A word of caution: Whether hand or pneumatic hammers are used, the operators must work generally parallel to the refractory surface—not into it! They should be made to understand that their job is to get the slag off without damage to the refractory brick. Tools and tool bits should be selected carefully with this in mind.

Expansion joints that may have become jammed with rigid materials such as bits of cement, fragments of brick or process by-products should be cleaned out and the space repacked.

Maintenance Repairs

Minor repairs, such as repointing brick and building up small damaged areas, should generally be accomplished with a refractory cement of the same materials as those in the part being repaired.

Loose brick should be replaced and cemented. Small cracks can be pointed up. Patches on worn areas can be applied by trowel or by ramming after carefully cleaning the cavity or area.

Packings that are sound and clean may be left in place. However, all expansion joints that needed cleaning will also need repacking. Fill all cleaned-out gaps carefully with refractory packing. Caulking around tubes and muffles should be replaced if necessary. Broken tile and shapes should be replaced.

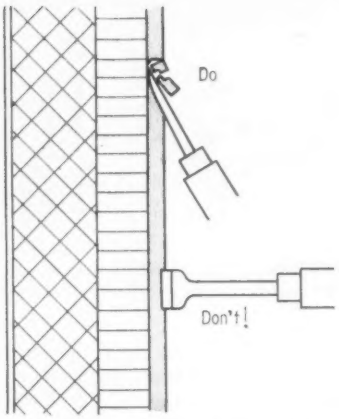
Analysis of Recurring Troubles

Up to this point, the minor repair jobs that can reasonably be expected to come up periodically have been considered briefly.

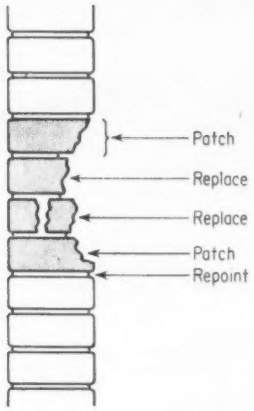
More extensive difficulties revealed by inspection, on the other hand, should not merely be covered up with a quick repair. This practice—unless accompanied by a remedy to prevent its repetition—leads to recurring maintenance.

Before repairs are started on a substantial part of the structure—or even a small part that has given trouble repeatedly in the past—it is well to pause and make an analysis of the failure to determine its cause. Sometimes a different method of repair will be more effective. Possibly a design modification or a material change that will prevent the undesirable failures can save the cost of further maintenance work and give longer uninterrupted life as well.

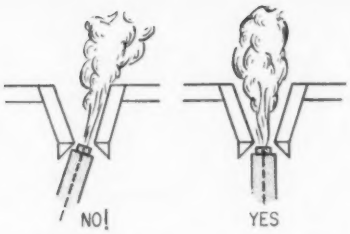
Rebuilding extensive areas of a re-



TO PREVENT damage to underlying brick, chip off slag on a parallel.



REPLACE enough of the brick so that a sound patch can be made readily.



BE SURE that burners are properly aligned to prevent surface erosion.

fractory structure should not be undertaken without a careful study as to the best approach. Whether to ram a monolithic lining, to tear out existing brick and replace it, to make a series of small patches or to consider a design modification should be determined on the basis of all facts available. On occasion, changes in materials may be considered, too.

Spalling should be identified as thermal spalling or stress spalling. Although the results are much the same, the cure may be different in the two cases.

Stress or pinching will cause spalling that displays an over-all pattern related to the structural conformation of the unit. Causes are inadequate provision for thermal expansion and overloading the brickwork.

The forces that cause stress spalling can usually be reduced to acceptable values by providing adequate expansion joints. The undersides of heavily-loaded arches and the inner walls of cylindrical structures gain protection if they are relieved at the joints between the brick for about 2 in. back from the surface. Cardboard strips—which burn out—are slipped into these joints to keep the spaces from being filled with cement.

Thermal spalling — the result of heat shock at the surface of each individual brick affected—can usually be identified by the fact that it occurs most severely where excessive temperature changes are experienced. Also, it is characterized by a continuing attack at the affected areas. Successive layers continue to spall off as new surface is exposed.

Remedies for thermal spalling include replacement of the material with one having greater spalling resistance. Another measure is the reduction of thermal gradient through that section of the structure involved. Modification of operating cycles may be desirable in some instances to prevent excessive thermal spalling.

Erosion by impingement of hot gases or liquids will create a repair job. Changing the flow might prove to be the solution to the need for future maintenance.

Baffles can be considered as flow-path modifiers. So can general arrangements of ducts and inlets in some cases. Relocation of burners may help to overcome the trouble.

Burner misalignment that causes erosion around burner ports is a very common source of trouble. Burners must be correctly centered in their ports and properly aligned.

Dimensions and clearances that deviate markedly from design specifications are signs that merit study.

Arches should conform to design contours. Any bulging or lack of symmetry is a serious matter. Appearances of the brick itself, in the skew support alignment and in expansion provisions are clues.

Temporary repairs can be made brick by brick, but it is far better practice to replace an entire arch section if its soundness is in doubt.

In tunnel kilns, ledge block clearances should be checked against track level and centerline with a gage, and allowance made for thermal expansion so that the desired clearances will exist when the kiln and cars are up to temperature.

Final Check

Having cleaned up the unit, made repairs, analyzed repeating failures and provided suitable remedies to minimize their recurrence, it is time to make a final inspection before putting the equipment back in service. Along with checking to be sure that all work has been done properly, it is good practice to make a detailed record as a basis for future observations.

Basic dimensions should be checked and recorded. Location of critical spots should be noted. Special materials should be identified so that performance can be evaluated. Future maintenance work will benefit by the completeness of the information available.

Operating Procedures Affect Maintenance

During regular operations, there are several precautions which can increase the life of a refractory structure and reduce the cost of maintaining it.

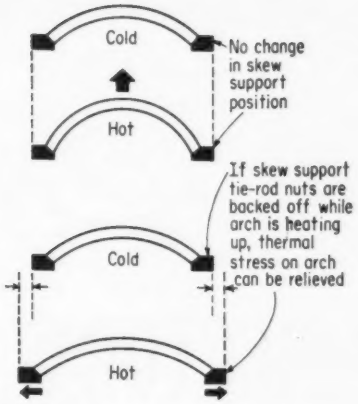
Heat-Up and Cooling-Down. A relatively small amount of extra time taken during heating and cooling will usually pay extra dividends in refractory life.

It is recognized, though, that some structures have to be heated and cooled rapidly. Reheating furnaces, for example, must work on the shortest practicable time cycles to pay their way economically. They are therefore built with high-quality super refractory materials in critical places.

A new furnace or a unit should be dried out slowly before it is brought up to service temperatures. It is recommended that the temperature be kept at about 200 deg F until all moisture has evaporated.

Again, in the range of 700 deg F, the heating rate should be slowed. Temperature can then be raised very slowly to about 1000 deg F. After that, the operator may bring the unit up to heat relatively rapidly.

Heating and cooling cycles should both be adjusted for a slowing down of temperature change in the 700 to 1000 deg F range. Ideally, for maximum life, it would be desirable to maintain a refractory structure above 1200 deg F continuously when not operative.


Cold
No change in skew support position
Hot
If skew support tie-rod nuts are backed off while arch is heating up, thermal stress on arch can be relieved
Cold
Hot

SKEWBACK support tie rods can be adjusted to minimize loads on arches.

Thermal shock can often be minimized by exercising these precautions.

A refractory shape or assembly that will be inserted into a heated furnace or bath should be preheated first. The mounting should be insulated—sometimes provided with heaters, too. If it is taken out hot, it should be covered with some insulating protection before it is laid on a cold floor.

Arch skew supports. An arch carries its own weight in such a way that it is under substantial compressive stress at all times. This stress increases as the arch expands during a rise of temperature. Unless the skews move, the arch must rise as it expands. When the structure carries a heavy load of insulating material this whole lifting effort may be borne by the hot, inner courses of brick.

Recognizing this fact, many operators back off the tie rods during the heating up period. Thus, the brickwork is allowed to expand outward, and it is relieved of most of the lifting load stress that would be imposed if it had to push upward. When cooling down, the tie rods are tightened to take the arch thrust.

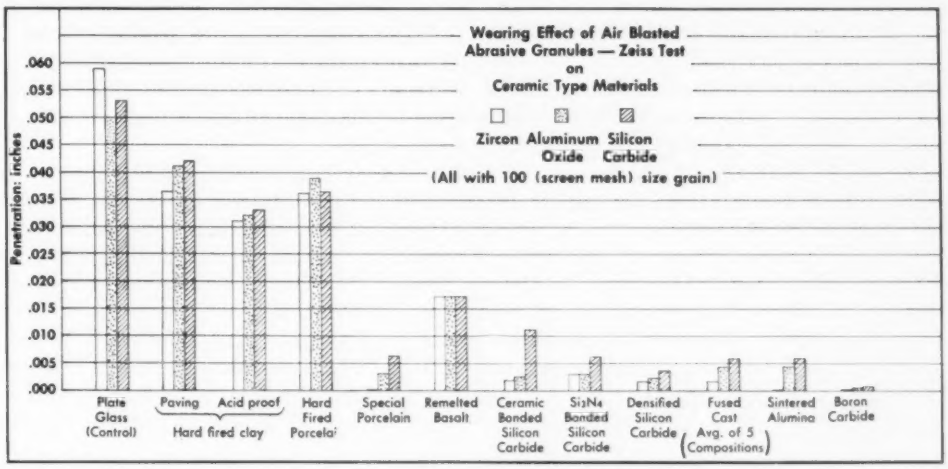
Corrosion during downtime. Super refractories applied for contact service with corrosive materials are chosen on the basis of maximum operating temperatures. Occasions have arisen where they have suffered attack, however, while units were out of service. This kind of trouble may involve condensate on cold surfaces.

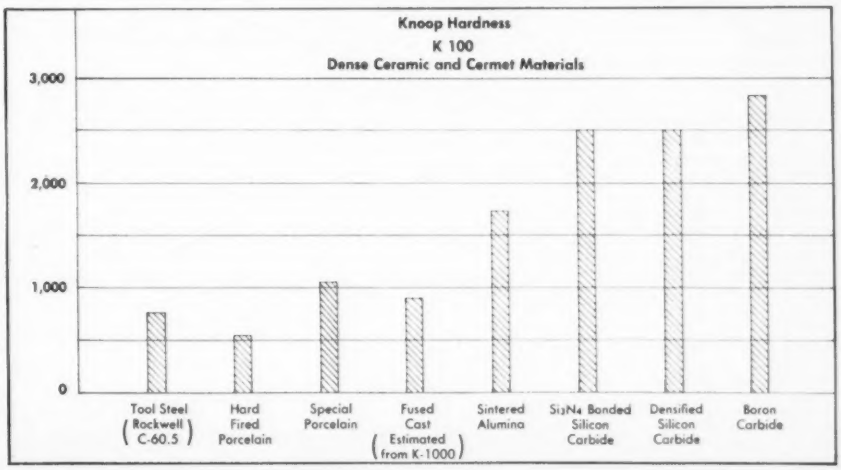
It is well to investigate possible harmful effects whenever a refractory structure must be left in contact with corrosive vapors for any length of time. Remedial action, such as applying a protective coating, keeping heat in the unit or providing ventilation may be advisable.

Cleanliness and housekeeping. The importance of good plant housekeeping has been mentioned in terms of overhaul and repair. It is possibly even more a factor during operations.

Ducts and flues should be kept clean so that draft and flow conditions will not be adversely affected. Dampers should not be allowed to get fouled.

Hearths can give trouble from stickiness. Covering the surface with silicon carbide grain and then scraping off the excess will help to cure this difficulty.





THERE ARE two types of abrasion responsible for the wearing away of a refractory surface—impingement by particulate matter in air, gas or liquid; and direct abrasion by a mass of wet or dry solids sliding on the surface. Materials shown in the graphs were tested by Carborundum Co. Upper graph illustrates resistance to impingement when sand-blasted with granules of zircon, alumina and silicon carbide. Lower graph indicates the resistance to direct abrasion as determined with a Knoop diamond-point tester.

For all products and services, use . . .

E&MJ's 1959 BUYING DIRECTORY

THE LISTINGS IN THE FOLLOWING PAGES are a handy spot-reference of equipment and services that will help you do your job more efficiently and profitably.

The Buying Directory is divided into three major sections:

1. **Classification of Products**
2. **Manufacturers' Index**
3. **Advertisers' District Sales Offices**

Classification of Products. More than 2,000 firms in the mining industry have listed equipment or services they wish to offer. This listing has been alphabetized both by item and company and cross-indexed to help you to find the product or service you want.

Manufacturers' Index. The second section of the Buying Directory lists, in alphabetical order, the manufacturers whose company names appear in the Classification of Products, along with their full mailing address.

You can get more information about a given product or service by checking the advertisement page numbers which also appear in the Manufacturers' Index. In each of the first two sections, advertisers are indicated by bold face capital letters. Page numbers are listed only in the second section.

District Sales Offices. This section is here for your convenience in getting more information about a given product or service and for the purchase of equipment through the handiest source.

Check the product classification for the manufacturing or service company which will answer your needs.

If the company name appears in bold face, the Manufacturers' Index will give you not only the address of the company, but the page on which that firm's ad appears in this issue. Check the ad for more information about the product. And, if you're interested in the advertiser's product, you'll find the listing of district sales offices very convenient. Main office addresses appear in the section as well.

If the name appears in light face type, you may obtain the address from the Manufacturers' Index.

Part I. Classification of Products

A

1 ABRASIVES — also see: Carbide; Diamonds

Aluminum Co. of America
American Coldset Corp.
Bay State Abrasive Products Co.
Chicago Wheel & Mfg. Co.
Diamond Drill Carbon Co.
Electro Refractories & Abrasives Corp.
EXOLON CO.
Hoffman Bros. Drilling Co.
Industrial Overlay Metals, Inc.
Linde Co., Div. Union Carbide Corp.
Macklin Co.
Metallurgical Products Dept., General Electric Co.
Minnesota Mining & Mfg. Co.
Norton Co.
Pettinos, Inc., George F.
Pickard Industries, Inc. Central Mine Supply Co., Div.
Precision Grinding Wheel Co., Inc.
Simonds Worden White Co.
Wheelabrator Corp.

(ACETYLENE GENERATORS —see Gas)

2 AERATORS

American Water Softener Co.
American Well Works
Bartlett & Snow Co., C.O.
BIN-DICATOR CO.
Booth Co.
Cochrane Corp.
DORR-OLIVER, INC.
EIMCO CORP.
Graver Water Conditioning Co.
INFILCO, INC.
JEFFREY MFG. CO.
Johnson Co., C.S.
LINK-BELT CO.
PERMUTIT CO., DIV. PFAUDLER PERMUTIT INC.
Penberthy Mfg. Co.

3 AERIAL CABLE TRAMWAYS—also see Excavators, Dragline Tower

Interstate Equipment Corp.
Lidgerwood Industries, Inc.
NORDBERG MFG. CO.
RIBLET TRAMWAY CO.
ROEBLING'S SONS CORP., JOHN A. SUBSIDIARY OF COLORADO FUEL & IRON CORP.
SAUERMAN BROS., INC.
Skookum Co., Inc.
Superior-Lidgerwood-Mundy Corp.
Swan Rubber Co.
U. S. STEEL CORP. COLUMBIA-GENEVA STEEL DIV.
Washington Iron Works.

(AGGLOMERATING — see: Nodulizing; Sintering; Water Clarification)

4 AGITATORS & MIXERS, GAS

American Well Works
MIXING EQUIPMENT CO.
Penberthy Mfg. Co.
PHILADELPHIA GEAR CORP.
TURBO-MIXER DIV. GENERAL AMERICAN TRANSPORTATION CORP.
Swan Rubber Co.

5 AGITATORS & MIXERS, LIQUIDS & SLURRIES—also see: Flotation Machines; Scrubbers

Abbé Engineering Co.
American Well Works
Atlantic Tank Corp.
Bethlehem Foundry & Machine Co.
Binks Mfg. Co.
Booth Co.
Canadian Locomotive Co., Ltd.
Christian Engineers, J. D.

Dagley Mfg. Co.
Denver Equipment Co.
DIESEL ENERGY CORP.
DORR OLIVER, INC.
Eagle Iron Works.
EIMCO CORP.
Fisher Scientific Co.
Galigher Co.
HARDINGE CO., INC.
Haynes Stellite Co., Div. Union Carbide Corp.
Hirsch Bros. Machy. Co.
INFILCO, INC.
MIXING EQUIPMENT CO.
Moran Engineering Co.
Morse Bros. Machinery Co.
Ogden Iron Works
Patterson Foundry & Machine Co.
PERMUTIT CO., DIV. PFAUDLER PERMUTIT, INC.
PHILADELPHIA GEAR CORP.
Standard Elec. Mfg. Co., Inc.
Troy Engine & Machine Co.
TURBO-MIXER DIV. GENERAL AMERICAN TRANSPORTATION CORP.
WEMCO, DIV., WESTERN MACHINERY CO.

6 AIRCRAFT

Beech Aircraft Corp.
Bell Helicopter Corp.
Cessna Aircraft Co.
Hiller Helicopters
PORTER COMPANY, INC., H.K., THERMOID DIV.
Sikorsky Div. United Aircraft Co.
Spartan Air Services
Swan Rubber Co.
U. S. RUBBER CO. MECHANICAL GOODS DIV.

7 AIR COMPRESSORS, MOVABLE & PORTABLE

Acme Machinery Co.
Airdox Cardox Products Co.
ALLIS-CHALMERS MFG. CO.
AMERICAN BRAKE SHOE CO.
ATLAS COPCO EASTERN, INC.
ATLAS COPCO PACIFIC, INC.
Beach-Russ Co.
Binks Mfg. Co.
Carrier Corp.
CHICAGO PNEUMATIC TOOL CO.
Curtis Manufacturing Co.
Davey Compressor Co.
Equitable Powder Mfg. Co.
Essick Manufacturing Co.
FULLER CO., SUBSIDIARY GENERAL AMERICAN TRANSPORTATION CORP.
GARDNER-DENVER CO.
Gray Co., Inc.
Hales Co., W. M.
Holman Bros.—Canada Ltd.
INGERSOLL-RAND CO.
Jaeger Machine Co.
JOY MFG. CO.
LE ROI DIV. WESTINGHOUSE AIR BRAKE CO.
Lincoln Engineering Co., Div. McNeil Machine & Engineering Co.
O.K. Machinery Div. John C. Motter Printing Press Co.
Olin-Mathieson Chemical Corp. Explosives Div.
Schramm, Inc.
Schroeder Brothers Corp.
Smith & Co., Gordon
Westinghouse Air Brake Co.
Worthington Corp.

8 AIR COMPRESSORS, ROTARY

Airdox Cardox Products Co.
ALLIS-CHALMERS MFG. CO.
Beach-Russ Co.
CHICAGO PNEUMATIC TOOL CO.
Davey Compressor Co.
FAIRBANKS, MORSE & CO.
FULLER CO., SUBSIDIARY GENERAL AMERICAN TRANSPORTATION CORP.
GARDNER-DENVER CO.
Holman Bros.—Canada Ltd.
INGERSOLL-RAND CO.
Jaeger Machine Co.
JOY MFG. CO.
Lincoln Engineering Co., Div. McNeil Machine & Engineering Co.
Nash Engineering Co.
Pickard Industries, Inc. Central Mines Supply Co., Div.
ROOTS-CONNERSVILLE BLOWER DIV. DRESSER INDUSTRIES, INC.
Wagner Electric Corp.
LE ROI DIV. WESTINGHOUSE AIR BRAKE CO.
Worthington Corp.

9 AIR COMPRESSORS, STATIONARY

Acme Machinery Co.
ALLIS-CHALMERS MFG. CO.
ATLAS COPCO EASTERN, INC.
ATLAS COPCO PACIFIC, INC.
Beach-Russ Co.
Binks Mfg. Co.
Carrier Corp.
CHICAGO PNEUMATIC TOOL CO.
Cooper-Bessemer Corp.
Curtis Manufacturing Co.
Davey Compressor Co.
Essick Manufacturing Co.
FULLER CO., SUBSIDIARY GENERAL AMERICAN TRANSPORTATION CORP.
GARDNER-DENVER CO.
Hales Co., W. M.
Holman Bros.—Canada Ltd.
Imperial-Cantrell Mfg. Co.
INGERSOLL-RAND CO.
Jaeger Machine Co.
JOY MFG. CO.
LE ROI DIV. WESTINGHOUSE AIR BRAKE CO.
Lima Electric Motor Co.
Lincoln Engineering Co., Div. McNeil Machine & Engineering Co.
Nash Engineering Co.
Olin-Mathieson Chemical Corp. Explosives Div.
Pennsylvania Pump & Compressor Co.
Schramm, Inc.
Schroeder Brothers Corp.
Smith & Co., Gordon
Spencer Turbine Co.
U. S. Hoffman Machinery Corp., Air Appliance Div.
Westinghouse Air Brake Co.
Westinghouse Air Brake Co. Ind. Products Div.
Worthington Corp.

10 AIR COMPRESSOR AFTERCOOLERS

American Standard Industrial Div.
ATLAS COPCO PACIFIC, INC.
Binks Mfg. Co.
CHICAGO PNEUMATIC TOOL CO.
Condenser Service & Engineering Co.
Curtis Manufacturing Co.
GARDNER-DENVER CO.
INGERSOLL-RAND CO.
Johnson Corp.
JOY MFG. CO.
LE ROI DIV., WESTINGHOUSE AIR BRAKE CO.
Pennsylvania Pump & Compressor Co.
Schramm, Inc.
Westinghouse Air Brake Co.

11 AIR LINE OILERS

Acme Machinery Co.
ATLAS COPCO PACIFIC, INC.
CHICAGO PNEUMATIC TOOL CO.
Cleco Div., Reed Roller Bit Co.
Davey Compressor Co.
EIMCO CORP.
GARDNER-DENVER CO.
Hayes Steel Products, Ltd.
Holman Bros.—Canada Ltd.
INGERSOLL-RAND CO.
JOY MFG. CO.
Schramm, Inc.
Thor Power Tool Co.
Wilkerson Corp.
VICTOR EQUIPMENT CO. ALLOY ROD & METAL DIV.
LE ROI DIV. WESTINGHOUSE AIR BRAKE CO.
Wright Power Saw & Tool Corp. Subsidiary of Thomas Industries

12 AIR MOTORS

Acme Machinery Co.
CHICAGO PNEUMATIC TOOL CO.
Cleco Div., Reed Roller Bit Co.
Detroit Hoist & Machine Co.
EIMCO CORP.
GARDNER-DENVER CO.
Holman Bros.—Canada Ltd.
INGERSOLL-RAND CO.
JOY MFG. CO.
LE ROI DIV. WESTINGHOUSE AIR BRAKE CO.
Remington Arms Co., Inc.
Thor Power Tool Co.

13 AIR RECEIVERS — also see Tanks

Acme Machinery Co.
ATLAS COPCO PACIFIC, INC.
Binks Mfg. Co.
Canadian Locomotive Co., Ltd.
Chattanooga Boiler & Tank Co.
CHICAGO PNEUMATIC TOOL CO.
Curtis Manufacturing Co.
Davey Compressor Co.
GARDNER-DENVER CO.
GENERAL AMERICAN TRANSPORTATION CORP.
Graver Tank & Mfg. Co., Div. Union Tank Car Co.
INGERSOLL-RAND CO.
JOY MFG. CO.
LE ROI DIV. WESTINGHOUSE AIR BRAKE CO.
Westinghouse Air Brake Co.
Westinghouse Air Brake Co. Ind. Products Div.
Wilkerson Corp.

14 AMALGAMATING PROCESS EQUIPMENT (SPECIAL)—does not include standard auxiliary equipment

DIESEL ENERGY CORP.
Denver Equipment Co.
BLAW-KNOX CO.
MINE & SMELTER SUPPLY CO., MFG. DIV.

(AMMETERS & VOLTMETERS —see Meters, Electricity)

(ANEMOMETERS — see Meters, Fluid)

15 ARRESTERS, LIGHTING

Carbone Corp.
DELTA-STAR ELECTRIC DIV. H. K. PORTER COMPANY, INC.
GENERAL ELECTRIC CO. APPARATUS SALES DIV.
Graybar Elec. Co., Inc.
Lafayette Radio Corp.
Line Material Industries, McGraw-Edison Co.
Ohio Brass Co.
Union Switch & Signal Div., Westinghouse Air Brake Co.
WESTINGHOUSE ELECTRIC CORP.
National Carbon Div. Union Carbide Corp.

(ASSAYING—see Laboratory)

B

16 BAG FILLING MACHINES

BEMIS BRO. BAG CO.
Chase Bag Co.
Chattanooga Boiler & Tank Co.
Consolidated Packaging Machinery Corp.
Kraft Bag Corp.
Richardson Scale Co.
St. Regis Paper Co.
West Virginia Pulp & Paper Co. Multiwall Bag Div.

17 BAGS, PAPER, FABRIC & PLASTIC—also see: Blasting Bags; Filter Bags

Albany Felt Co.
BEMIS BRO. BAG CO.
Chase Bag Co.
Daniels Co. Contractors, Inc.
Daniels, Inc., C. R.
Equitable Paper Bag Co., Inc.
Gering Products, Inc.
Hutchinson Bag Corp.
Kraft Bag Corp.
Miller Equipment Co., Inc.
NATIONAL FILTER MEDIA CORP.
Pendleton Woolen Mills
St. Regis Paper Co.
Snyder & Son, Inc., M. L.
Stanley Co., Inc., William W.
Visking Co. Plastics Div., Union Carbide Corp.
West Virginia Pulp & Paper Co., Multiwall Bag Div.

(BALL MILLS — see Mills)

18 BARGES, FLOATING

BETHLEHEM STEEL CO.
DRAVO CORP.
Kaiser Steel Corp., Fabricating Div.
Pacific Coast Engineering Co.
Wiley Mfg. Co.
YUBA CONSOLIDATED INDUSTRIES, INC.

(BATTERIES, STORAGE—see Electric Batteries, Dry and Storage)

19 BEARINGS, BALL

Aetna Ball & Roller Bearing Co., Div. Parkersburg-Aetna Corp.
Ahlberg Bearing Co.
Coors Porcelain Co.
Corning Glass Works
DODGE MFG. CORP.
Fafnir Bearing Co.
Federal Bearings Co., Inc.
Bearings Co. of America Div. Federal-Mogul-Bower Bearings, Inc.
Gwilliam Co.
Kaydon Engineering Corp.
LINK-BELT CO.
Marlin-Rockwell Corp.
New Departure Div. General Motors
Nice Ball Bearing Co.
Norma-Hoffman Bearings Corp.
Schatz Mfg. Co.
SKF Industries, Inc.
Split Ballbearing Corp.
Stephens-Adamson Mfg. Co.
Torrington Co. Bantam Bearings Div.
Tyson Bearing Co., Div. SKF Industries, Inc.
Wood's Sons Co., T. B.

20 BEARINGS, NEEDLE

Kaydon Engineering Corp.
McGill Mfg. Co., Inc.
Orange Roller Bearing Co., Inc.
Torrington Co. Bantam Bearings Div.

21 BEARINGS, PLAIN, NON-METALLIC

AMERICAN BRAKE SHOE CO.
Carbone Corp.
Continental-Diamond Fibre Corp.
Gatke Corp.
Helwig Co.
McMillan's Sons, W. H.
National Carbon Co., Div. Union Carbide Corp.
Ohio Carbon Co.
Pure Carbon Co.
Renner Inc.
Stackpole Carbon Co.
Synthane Corp.

22 BEARINGS, PLAIN, OIL-IMPREGNATED & SINTERED METAL

Bunting Brass & Bronze Co.
Carbone Corp.
DODGE MFG. CORP.
Eaton Mfg. Co.
Federal-Mogul Service Div. Federal-Mogul-Bower Bearings, Inc.
Helwig Co.
Johnson Bronze Co.
Keystone Carbon Co.
Olds Alloy Co.
Pure Carbon Co.
Wood's Sons Co., T. B.

23 BEARINGS, ROLLER

Aetna Ball & Roller Bearing Co. Div. Parkersburg-Aetna Corp.
Bower Roller Bearing Div. Federal-Mogul-Bower Bearings, Inc.
Chain Belt Co. Shafer Bearing Div.
Corning Glass Works
DODGE MFG. CORP.
Federal-Mogul Service Div. Federal-Mogul-Bower Bearings, Inc.
GENERAL MOTORS CORP. HYATT BEARINGS DIV.
Gibraltar Equipment & Mfg. Co.
Gwilliam Co.
HEWITT-ROBINS, INC.
Kaydon Engineering Corp.
LINK-BELT CO.
Marlin-Rockwell Corp.
McGill Mfg. Co., Inc.
Norma-Hoffman Bearings Corp.
Orange Roller Bearing Co., Inc.
Rollway Bearing Co., Inc.
TIMKEN ROLLER BEARING CO.
Torrington Co. Bantam Bearings Div.
Tyson Bearing Co. Div. SKF Industries, Inc.

24 BEARINGS, SLEEVE

American Brake Shoe Co.
American Crucible Products Co.
Ampco Metal, Inc.
Bunting Brass & Bronze Co.
Carbone Corp.
Coors Porcelain Co.

DODGE MFG. CORP.
Federal-Mogul Service Div. Federal-Mogul-Bower Bearings, Inc.
Flood City Brass & Elec. Co.
Gatke Corp.
GENERAL MOTORS CORP., ALLISON DIV.
Haynes Stellite Co. Div. Union Carbide Corp.
Imperial-Cantrell Mfg. Co.
Johnson Bronze Co.
LINK-BELT CO.
Lumen Bearing Co.
Ohio Carbon Co.
Olds Alloy Co.
STEARNS ROGER MFG. CO.
West Virginia Armature Co.
Williams & Son. E. A.

25 BEARINGS, THRUST

Aetna Ball & Roller Bearing Co. Div. Parkersburg-Aetna Corp.
AMERICAN BRAKE SHOE CO.
American Crucible Products Co.
Bartlett & Snow Co., C. O.
Bearings Co. of America Div. Federal-Mogul-Bower Bearings, Inc.
Brass Foundry Co.
Bunting Brass & Bronze Co.
Carbone Corp.
Coors Porcelain Co.
DODGE MFG. CORP.
Federal Bearings Co., Inc.
Gatke Corp.
GENERAL MOTORS CORP., ALLISON DIV.
Gibraltar Equipment & Mfg. Co.
Gwilliam Co.
Johnson Bronze Co.
Kaydon Engineering Corp.
LINK-BELT CO.
Lumen Bearing Co.
Marlin-Rockwell Corp.
New Departure Div. General Motors Corp.
Nice Ball Bearing Co.
Ohio Carbon Co.
Olds Alloy Co.
Orange Roller Bearing Co., Inc.
Rollway Bearing Co., Inc.
Saginaw Bearing Co.
Schatz Mfg. Co.
SKF Industries, Inc.
TIMKEN ROLLER BEARING CO.
Torrington Co.
Torrington Co. Bantam Bearings Div.
Tyson Bearing Co., Div. SKF Industries, Inc.
Williams & Son, E. A.

26 BEARING METAL

Aluminum Co. of America
AMERICAN BRAKE SHOE CO.
American Crucible Products Co.
AMERICAN SMELTING & REFINING CO. FEDERATED METALS DIV.
Ampco Metal Inc.
Belmont Smelting & Refining Works, Inc.
Cadman Mfg. Co., A. W.
Carpenter Steel Co.
CRUCIBLE STEEL CO. OF AMERICA
Firth Sterling Inc.
Flood City Brass & Electric
Haynes Stellite Co. Div. Union Carbide Corp.
Imperial-Cantrell Mfg. Co.
Johnson Bronze Co.
LINK-BELT CO.
Lumen Bearing Co.
Mueller Brass Co.
National Lead Co.
Olds Alloy Co.
Spang & Co.

27 BEARING PILLOW BLOCKS HANGERS & JOURNAL BOXES

Ahlberg Bearing Co.
Bartlett & Snow Co., C. O.
Browning Mfg. Co.
CARD IRON WORKS, C. S.
Chain Belt Co. Shafer Bearing Div.
CONTINENTAL GIN CO. INDUSTRIAL DIV.
DODGE MFG. CORP.
Fafnir Bearing Co.
Gatke Corp.
GENERAL MOTORS CORP., HYATT BEARINGS DIV.
HEWITT-ROBINS, INC.
JEFFREY MFG. CO.
Johnson Bronze Co.
Kanawha Mfg. Co.
LINK-BELT CO.
Lumen Bearing Co.
Marlin-Rockwell Corp.
McNALLY PITTSBURG MFG. CORP.
New Departure Div. General Motors Corp.
Pickard Industries, Inc. Central Mine Supply Co., Div.
SKF Industries, Inc.
Stephens-Adamson Mfg. Co.
Tyson Bearing Co., Div. SKF Industries, Inc.
Webster Mfg., Inc.
Wood's Sons Co., T. B.

(BELTS, CONVEYOR — see Conveyor Belting)

28 BELTS, FLAT POWER TRANSMISSION

Acme Rubber Mfg. Co.
American Rubber Mfg. Co.
BOSTON WOVEN HOSE & RUBBER CO.
Carlyle Rubber Co.
Chicago Belting Div. Chicago-Allis Mfg. Corp.
Cincinnati Rubber Mfg. Co. Div. Thor Power Tool Co.
Daniels, Inc., C. R.
Dick Co., R & J
Extremultus, Inc.
GATES RUBBER CO.
Goodall Rubber Co.
GOODRICH INDUSTRIAL PRODUCTS CO., B. F.
GOODYEAR TIRE & RUBBER CO.
GOODYEAR TIRE & RUBBER CO. INDUSTRIAL PRODUCTS
Graton & Knight Co.
HAMILTON RUBBER MFG. CORP.
HEWITT-ROBINS, INC.
Houghton & Co., E. F.
Johnson Belting Co.
Lovejoy Flexible Coupling Co.
Manheim Mfg. & Belting Co.
Missouri Belting Co.
Morse Chain Co.
New York Belting & Packing Co.
New York Rubber Corp.
Philadelphia Belting Co.
PORTER COMPANY, INC., H. K. THERMOID DIV.
RAYBESTOS-MANHATTAN, INC. MANHATTAN RUBBER DIV.
Republic Rubber Div. Lee Rubber & Tire Corp.
Rhoads & Son, J. E.
Scandinavia Belting Co.
Thor Power Tool Co.
U. S. RUBBER CO.
U. S. RUBBER CO. MECHANICAL GOODS DIV.
Webb Belting & Supply Co.
Williams, I. B & Sons

29 BELTS, "V"

ALLIS-CHALMERS MFG. CO.
AMERICAN PULLEY CO.
BOSTON WOVEN HOSE & RUBBER CO.
Brammer Corp.
Browning Mfg. Co.
Carlyle Rubber Co.
Dick Co., R & J.
DODGE MFG. CORP.
GATES RUBBER CO.
Goodall Rubber Co.
GOODRICH INDUSTRIAL PRODUCTS, CO., B. F.
GOODYEAR TIRE & RUBBER CO.
GOODYEAR TIRE & RUBBER CO. INDUSTRIAL PRODUCTS
Graton & Knight Co.
LINK-BELT CO.
Lovejoy Flexible Coupling Co.
Manheim Mfg. & Belting Co.
Missouri Belting Co.
New York Belting & Packing Co.
PORTER COMPANY, INC., H. K. THERMOID DIV.
RAYBESTOS-MANHATTAN, INC. MANHATTAN RUBBER DIV.
Rhoads & Son, J. E.
U. S. RUBBER CO.
U. S. RUBBER CO. MECHANICAL GOODS DIV.
Webb Belting & Supply Co.
Worthington Corp.

30 BELT DRESSING

Chicago Belting Div. Chicago-Allis Mfg. Corp.
Cling-Surface Co.
Daniels, Inc., C. R.
Dixon Crucible Co., Joseph
GOODRICH INDUSTRIAL PRODUCTS CO., B. F.
Graton & Knight Co.
Houghton & Co., E. F.
Johnson Belting Co.
Missouri Belting Co.
Philadelphia Belting Co.
Rhoads & Son, J. E.
Scandinavia Belting Co.
Webb Belting & Supply Co.

31 BINS & HOPPERS, BULK SOLIDS STORAGE—for liquids see Tanks

Acme Road Machinery Co., Inc.
Armco Drainage & Metal Products, Inc.
Arrow Tank Co.
Arrowhead Steel Buildings, Inc.
BALDWIN - LIMA - HAMILTON CORP. CONSTRUCTION EQUIPMENT DIV.
BARBER-GREENE CO.
Bartlett & Snow Co., C. O.
BETHLEHEM STEEL CO., INC.
BLAW-KNOX CO.
Bodinson Manufacturing Co., Inc.
Butler Bin Co.
Butler Mfg. Co.
Caldwell Co., W. E.
Canadian Locomotive Co., Ltd.
CARD IRONWORKS, C. S.
Chattanooga Boiler & Tank Co.
Chicago Bridge & Iron Co.
Columbian Steel Tank Co.
CONNELLSVILLE MFG. & MINE SUPPLY CO.
Daniels Co. Contractors, Inc.
Denver Equipment Co.
Diamond Iron Works Div. Goodman Mfg. Co.
Engineered Equipment Inc.
Enterprise Wheel & Car Corp.
Erie Strayer Co.
Fuller Co.
Graver Tank & Mfg. Co., Div. Union Tank Car Co.
Gruendler Crusher & Pulverizer Co.
Hack Engineering Co.
Heineken, Inc. W. P.
HEWITT-ROBINS, INC.
Hirsch Bros. Machy. Co.
Holmes & Bros., Inc. Robert
Industrial Engrg. & Construction Co.
IOWA MFG. CO.
Irwin-Sensenich Corp.
Johnson Co., C. S.
Kanawha Mfg. Co.
KENNEDY-VAN SAUN MFG. & ENG. CORP.
Kenyon Walker Machinery Co.
Kirk & Blum Mfg. Co.
Lakeside Bridge & Steel Co.
LINK-BELT CO.
Lippmann Engineering Works, Inc.
Mahon Co., R. C.
Marietta Concrete Corp.
Marsh Engineering Co., E. F.
Mayo Tunnel & Mine Equipment
McDowell Co., Inc.
Meckum Engineering Inc.
Neff & Fry Co.
Ogden Iron Works
Ottumwa Box Car Loader Co.
Pioneer Engineering Div. Poor & Co. Inc.
Prins & Associates, K.
Richardson Scale Co.
Roberts & Schaefer Co., Subsidiary of Thompson Starrett Co., Inc.
Rogers Iron Works Co.
Santa Fe Tank Div. Fluor Products Co.
Schneible Co., Claude B.
Specialty Engineering Co.
Standard Steel Corp.
STEARNS ROGER MFG. CO.
Stephens-Adamson Mfg. Co.
Telluride Iron Works Co.
TREADWELL CO., M. T.
Universal Road Machinery Co.
Washington Machinery Co.
Webb Belting & Supply Co.
Webster Mfg., Inc.
Wellman Engineering Co.
YUBA CONSOLIDATED INDUSTRIES, INC., YUBA MANUFACTURING DIV.

32 BIN & CHUTE GATES AND MECHANISMS—also see Feeders

ABCs Scale Div., McDowell Co., Inc.
Acme Road Machinery Co., Inc.
Bartlett & Snow Co., C. O.
Bodinson Manufacturing Co., Inc.
Butler Bin Co.
Butler Mfg. Co.
Canadian Locomotive Co., Ltd.
CARD IRON WORKS, C. S.
Chain Belt Co.
Columbus Conveyor Co.
Denver Equipment Co.
Engineered Equipment Inc.
Erie Strayer Co.
Gruendler Crusher & Pulverizer Co.
Hack Engineering Co.
Helmick Foundry-Machine Co.
HEWITT-ROBINS, INC.
Hirsch Bros. Machy. Co.
Holmes & Bros., Inc. Robert
Industrial Engrg. & Construction Co.
JEFFREY MFG. CO.
Johnson Co., C. S.
LINK-BELT CO.
Lippmann Engineering Works, Inc.
Marsh Engineering Co., E. F.
Mayo Tunnel & Mine Equipment
McNALLY PITTSBURG MFG. CORP.
Meckum Engineering Inc.
MERRICK SCALE MFG. CO.
NATIONAL IRON CO.
Ogden Iron Works
Pioneer Engineering Div. Poor & Co. Inc.
Prins & Associates, K.
Richardson Scale Co.
Roberts & Schaefer Co., Subsidiary of Thompson Starrett Co., Inc.
Rogers Iron Works Co.
Schroeder Brothers Corp.
Smith Engineering Works
Specialty Engineering Co.
Standard Steel Corp.
STEARNS ROGER MFG. CO.
Stephens-Adamson Mfg. Co.
Telluride Iron Works Co.
Universal Dredge Mfg. Co.
Universal Road Machinery Co.
Washington Machinery Co.
Webb Belting & Supply Co.
Webster Mfg., Inc.

33 BINS & TANK-LEVEL INDICATORS—also see Meters & Gages

Bin-Dicator Co.
B-I-F Industries, Inc.
Butler Bin Co.
Convair, Inc.
Electronics Div., Diamond Power Specialty Corp.
Engineered Equipment Inc.
Erie Strayer Co.
Falcon Alarm Co., Inc.
Femco, Inc.
Fuller Co.
GENERAL AMERICAN TRANSPORTATION CORP.
General Equipment & Mfg. Co.
HEWITT-ROBINS, INC.
INDUSTRIAL PHYSICS & ELECTRONICS CO.
JEFFREY MFG. CO.
Nuclear Research Corp.
Revere Corp. of America
Santa Fe Tank Div. Fluor Products Co.
Stephens-Adamson Mfg. Co.
Syntron Co.
Texas Instruments Inc. Industrial Instrumentation Div.
Vapor Recovery Systems Co.

(BITS—see Drill (Rock) Bits)

34 BLAST CLEANING EQUIPMENT

Macklin Co.
Norton Co.
Pangborn Corp.
Pettinos, Inc., George F.
SLY MFG. CO., W. W.
U. S. RUBBER CO. MECHANICAL GOODS DIV.
Wheelabrator Corp.

35 BLASTING COMPOUNDS (i.e., EXPLOSIVES)

AMERICAN CYANAMID CO.
Apache Powder Co.
ATLAS POWDER CO.
Austin Powder Co.
Canadian Industries, Ltd.
Collier Carbon & Chemical Corp.
Columbia Powder Co.
Commercial Solvent Corp.
DuPont de Nemours & Co., Inc., E. I. Explosives Dept.
DuPont de Nemours & Co., Inc., E. I. Egyptian Powder Co.
Equitable Powder Mfg. Co.
HERCULES POWDER CO.
National Powder Co.
Olin-Mathieson Chemical Corp. Explosives Div.
Pacific Powder Co.
Spencer Chemical Co.
Trojan Powder Co.
U. S. Powder Co.
West Coast Powder Co.

36 BLASTING DETONATORS (i.e. CAPS)

AMERICAN CYANAMID CO.
Apache Powder Co.
ATLAS POWDER CO.
Canadian Industries Ltd.
DuPont de Nemours & Co., Inc., E. I.
DuPont de Nemours & Co., Inc., E. I. Explosives Dept.
Equitable Powder Mfg. Co.
HERCULES POWDER CO.
National Powder Co.
Olin-Mathieson Chemical Corp., Explosives Div.
Trojan Powder Co.

37 BLASTING FUSES, SAFE-

TY, DETONATING, et al

AMERICAN CYANAMID CO.
Apache Powder Co.
ATLAS POWDER CO.
Canadian Industries Ltd.
Coast Mfg. & Supply Co.
DuPont de Nemours & Co., Inc., E. I. Explosives Dept.
DuPont de Nemours & Co., Inc., E. I.
ENSIGN-BICKFORD CO.
Equitable Powder Mfg. Co.
HERCULES POWDER CO.
National Fuse & Powder Co.
National Powder Co.
Olin-Mathieson Chemical Corp. Explosives Div.
Spencer Chemical Co.
Trojan Powder Co.

38 BLASTING BAGS, POWDER & TAMPING

AMERICAN CYANAMID CO.
Apache Powder Co.
ATLAS POWDER CO.
BEMIS BROS. BAG CO.
Canadian Industries Ltd.
Chase Bag Co.
DuPont de Nemours & Co., Inc., E. I. Explosives Dept.
DuPont de Nemours & Co., Inc., E. I.
Fulton Bag & Products Co.
Hammond Co., J. V.
HERCULES POWDER CO.
NATIONAL MINE SERVICE CO.
National Powder Co.
Olin-Mathieson Chemical Corp. Explosives Div.
Pickard Industries, Inc. Central Mines Supply Co., Div.
Trojan Powder Co.
Visking Co. Plastics Div.

39 BLASTING EQUIPMENT & ACCESSORIES, MISCELLANEOUS

Abbott, Charles & Associates
AMERICAN CYANAMID CO.
Apache Powder Co.
ATLAS POWDER CO.
Canadian Industries Ltd.
DuPont de Nemours & Co., Inc., E. I.
DuPont de Nemours & Co., Inc., E. I. Explosives Dept.
ENSIGN-BICKFORD CO.
Equitable Powder Mfg. Co.
Falcon Alarm Co., Inc.
Femco, Inc.
Gray Instrument Co.
Hammond Co., J. V.
HERCULES POWDER CO.
Johnson Loading Supplies, G. R.
National Fuse & Powder Co.
NATIONAL MINE SERVICE CO.
National Powder Co.
Olin-Mathieson Chemical Corp. Explosives Div.
Southwestern Industrial Electronics Co.
Spencer Chemical Co.
Sprengnether Instrument Co., Inc., W. F.
STOODY CO.
Texas Instruments, Inc. Industrial Instrumentation Div.
Trojan Powder Co.
VICTOR EQUIPMENT CO. ALLOY ROD & METAL DIV.

40 BLASTING MACHINES & SWITCHES, ELECTRIC

AMERICAN CYANAMID CO.
Apache Powder Co.
ATLAS POWDER CO.
DuPont de Nemours & Co., Inc., E. I. Explosives Dept.
HERCULES POWDER CO.

41 BLASTING (& CONNECTING) WIRE

AMERICAN CYANAMID CO.
Apache Powder Co.
ATLAS POWDER CO.
Canadian Industries Ltd.
COLORADO FUEL & IRON CORP.
DuPont de Nemours & Co., Inc., E. I.
DuPont de Nemours & Co., Inc., E. I. Explosives Dept.
General Cable Corp.
HERCULES POWDER CO.
National Powder Co.
Olin-Mathieson Chemical Corp. Explosives Div.
Pickard Industries, Inc. Central Mine Supply Co. Div.
ROEBLING'S SONS CORP., JOHN A. SUBSIDIARY OF COLORADO FUEL & IRON CO.
Rome Cable Corp.
Trojan Powder Co.
WICKWIRE SPENCER STEEL DIV. COLORADO FUEL & IRON CORP.

42 BLOCKS, PULLEYS & SHEAVES — also see Sheaves, Mine Hoist

Alloy Steel & Metals Co.
AMERICAN HOIST & DERRICK CO.
AMERICAN PULLEY CO.
Bartlett & Snow Co., C. O.
Bonded Scale & Machine Co.
Browning Mfg. Co.
CARD IRON WORKS, C. S.
Coeur d'Alene Hardware & Foundry Co.
CONTINENTAL GIN CO. INDUSTRIAL DIV.
Dick Co., R. & J.
DODGE MFG. CORP.
Electric Steel Foundry Co.
Farrel-Cheek Steel Co.
Frog, Switch & Mfg. Co.
Griphoist, Inc.
HEWITT-ROBINS, INC.
Holmes & Bros. Inc. Robert
JOY MFG. CO.
Keeney Co., Paul E.
Lake Shore, Inc. Lake Shore Engineering Div.
Lebus Mfg. Co. Subsidiary of American Hoist & Derrick Co.
LINK-BELT CO.
Lippmann Engineering Works, Inc.
Lovejoy Flexible Coupling Co.
Madesco Tackle Block Co.
McDowell Co., Inc.
McMillan's Sons, W. H.
McNALLY PITTSBURG MFG. CORP.
Paulsen-Webber Cordage Corp.
Princeton Griphoist, Inc.
Sanford-Day Iron Works, Inc.
SAUERMAN BROS., INC.
Skookum Co., Inc.
Stephens-Adamson Mfg. Co.
Stroh Process Steel Co.
Telluride Iron Works, Co.
Tool Steel Gear & Pinion Co.
U. S. RUBBER CO. MECHANICAL GOODS DIV.
Washington Iron Works
Washington Machinery Co.
Wellman Engineering Co.
Western Block Co.
Wood's Sons Co., T. B.

(BLOWERS—see: Fans; Concrete Sprayers; Refractory Placers)

43 BLUE, PHOTO & WHITE PRINT MACHINES

Bruning Co., Inc. Charles
Ozalid Div. General Aniline & Film Corp.
Paragon-Revolute Corp.
Pease Co., C. F.
Peck & Harvey Mfg. Corp.
Pearless Photo Products, Inc.
Post Co., Frederick
Remington Rand Div. Sperry Rand Corp.
Suverkrop Instruments.

44 BOILERS & HEATERS, LIQUID—does not include: Heaters, Space; Retorts

American Standard Industrial Div.
Alco Products, Inc.
Ames Iron Works, Inc.
BABCOCK & WILCOX CO.
Clayton Mfg. Co.
Cochrane Corp.
Combustion Engineering Inc.
Condenser Service & Engineering Co.
Foster Wheeler Corp.
Industrial Brownhoist Corp.
Keeler Co., E.
Leffel & Co., James
Ogden Iron Works
Process Engineering, Inc.
Prox Co., Inc. Frank
Quick Charge, Inc.
Southwestern Engineering Co.
Springfield Boiler Co.
YUBA CONSOLIDATED INDUSTRIES, INC., ADSCO DIV.
WESTERN PRECIPITATION CORP.

(BOLTS — see: Fasteners; Rock Bolts)

(BOOMS, LOADING — see: Cranes; Conveyors)

45 BOOMS & TOWERS, EXTENSIBLE & MOTILE, MOBILE & STATIONARY—does not include: Drill (Rock) Booms; Drill (Rock) Jumbos; Booms, Loading

Ballymore Co.
Dominion Steel & Coal Corp., Ltd.
HEWITT-ROBINS, INC.
INGERSOLL-RAND CO.
LINK-BELT CO.
McKiernan-Terry Corp.
Mobile Aerial Towers, Inc.

46 BRAKES, DYNAMIC—also see Brakes, Magnetic

WESTINGHOUSE ELECTRIC CORP.

47 BRAKES, FRICTION DISK & BLOCK

AMERICAN BRAKE SHOE CO.
American Chain & Cable Co., Inc. Automotive & Aircraft Div.
Asbestos Mfg. Co.
CONNELLSVILLE MFG. & MINE SUPPLY CO.
Fawick Airflex Co., Inc.
Gatke Corp.
GOODRICH AVIATION PRODUCTS, B. F. DIV., GOODRICH CO., B. F.
GOODYEAR TIRE & RUBBER CO.
Johns-Manville
Pickard Industries, Inc. Central Mine Supply Co. Div.
PORTER COMPANY, INC., H. K. THERMOID DIV.
Rockwell Spring & Axle Co. Timken-Detroit Axle Div.
Scandinavia Belting Co.
Wagner Electric Corp.
Wellman Co., S. K.

48 BRAKES, MAGNETIC

American Rectifier Corp. Selenibrake Div.
Clark-Controller Co.
Cutler-Hammer, Inc.
Dings Magnetic Separator Co.
Eaton Mfg. Co.
Electric Controller & Mfg. Co. Div. Square D. Co.
GENERAL ELECTRIC CO. APPARATUS SALES DIV.
Miehle Printing Press & Mfg. Co. Star-Kimble Motor Div.
Trombeta Solenoid Corp.
WESTINGHOUSE ELECTRIC CORP.

49 BRATTICE CLOTH

AMERICAN BRATTICE CLOTH CORP.
Daniels, Inc., C. R.
Flocker & Co., John
GOODRICH INDUSTRIAL PRODUCTS CO., B. F.
Johnston-Morehouse-Dickey Co.
Pickard Industries, Inc. Central Mine Supply Co., Div.
West Virginia Pulp & Paper Co., Multiwall Bag Div.

50 BRIQUETTING EQUIPMENT — does not include: Nodulizing, Pelletizing-Balling or Sintering Equipment

Hazemag USA Inc.

51 BUCKETS, BUCKETLINE DREDGE

AMERICAN BRAKE SHOE CO. AMERICAN MANGANESE STEEL DIV.
AMERICAN BRAKE SHOE CO.
Columbia Steel Casting Co., Inc.
Electric Steel Foundry Co.
Frog, Switch & Mfg. Co.
Kensington Steel Co.
Pettibone Mulliken Co.
Sorel Steel Foundries, Ltd.
Washington Iron Works
Yaun Mfg. Co., Inc.
YUBA CONSOLIDATED INDUSTRIES, INC., YUBA MINING DIV.

52 BUCKETS, CLAMSHELL & GRAB

BLAW-KNOX CO.
Electric Steel Foundry Co.
Erie Strayer Co.
Frog Switch & Mfg. Co.
Hales Co., W. M.
HARNISCHFEGER CORP.
Hayward Co.
Industrial Brownhoist Corp.
Johnson. Co., C. S.
McKiernan-Terry Corp.
Orton Crane & Shovel Co.
Owen Bucket Co.
Pettibone Mulliken Corp.
Salem-Broslus, Inc.
Schield Bantam Co.
Williams Bucket Div., Wellman Engineering Co.
Yaun Mfg. Co., Inc.
YUBA CONSOLIDATED INDUSTRIES, INC., YUBA MINING DIV.

53 BUCKETS, CONVEYOR & ELEVATOR—does not include Buckets, Tramway & Trolley

Acme Road Machinery Co., Inc.
AMERICAN BRAKE SHOE CO. AMERICAN MANGANESE STEEL DIV.
Bartlett & Snow Co., C. O.
B-I-F Industries, Inc.
Bodinson Manufacturing Co., Inc.
Bonded Scale & Machine Co.
Butler Bin Co.
Butler Mfg. Co.
Chain Belt Co.
Christian Engineers, J. D.
Columbia Steel Casting Co., Inc.
Columbus Conveyor Co.
CONTINENTAL GIN. CO. INDUSTRIAL DIV.
Erie Strayer Co.
Farrell-Cheek Steel Co.
Gibraltar Equipment & Mfg. Co.
GOODRICH INDUSTRIAL PRODUCTS CO., B. F.
Gruendler Crusher & Pulverizer Co.
Hack Engineering Co.
Heineken, Inc. W. P.
Helmick Foundry-Machine Co.
HENDRICK MFG. CO.
HEWITT-ROBINS, INC.
JEFFREY MFG. CO.
Johnson Co., C. S
Kanawha Mfg. Co.
Kensington Steel Co.
Kirk & Blum Mfg. Co.
Kremser & Sons, Inc. Frank A.
Laubenstein Mfg. Co.
LINK-BELT CO.
Lippmann Engineering Works, Inc.
Marsh Engineering Co., E. F.
McNALLY PITTSBURGH MFG. CORP.
Moline Malleable Iron Co.
NATIONAL MALLEABLE & STEEL CASTINGS CO.
Ogden Iron Works
Pettibone Mulliken Corp.
Pioneer Engineering Div. Poor & Co. Inc.
Roberts & Schaefer Co., Subsidiary of Thompson Starrett Co., Inc.
Rogers Iron Works Co.
Savage Co., W. J.
Specialty Engineering Co.
Standard Metal Mfg. Co.
Stephens-Adamson Mfg. Co.
Union Chain & Mfg. Co.
Universal Dredge Mfg. Co.
Universal Road Machinery Co.
Washington Machinery Co.
Webster Mfg., Inc.

54 BUCKETS, DIPPER SHOVEL

AMERICAN BRAKE SHOE CO. AMERICAN MANGANESE STEEL DIV.
AMERICAN BRAKE SHOE CO.
BUCYRUS-ERIE CO.
Columbia Steel Casting Co., Inc.
Electric Steel Foundry Co.
Frog, Switch & Mfg. Co.
Landis Steel Co.
Orton Crane & Shovel Co.
Pettibone Mulliken Corp.
Schield Bantam Co.
Sorel Steel Foundries, Ltd.

55 BUCKETS, DRAGLINE CRANE

BUCYRUS-ERIE CO.
DRAVO CORP.
Electric Steel Foundry Co.
Frog, Switch & Mfg. Co.
Hales Co., W. M.
HARNISCHFEGER CORP.
HENDRIX MFG. CO.
Orton Crane & Shovel Co.
Page Engineering Co.
Pettibone Mulliken Corp.
Schield Bantam Co.
Sorel Steel Foundries, Ltd.
Williams Bucket Div., Wellman Engineering Co.
Yaun Mfg. Co., Inc.

56 BUCKETS, DRAGLINE SCRAPER-SLUSHER

Alloy Steel & Metals Co.
AMERICAN MANGANESE STEEL DIV., AMERICAN BRAKE SHOE CO.
Columbia Steel Casting Co., Inc.
EIMCO CORP.
Electric Steel Foundry Co.
Frog Switch & Mfg. Co.
JOY MFG. CO.
Landis Steel Co.
Orton Crane Shovel Co.
Pettibone Mulliken Corp.
SAUERMAN BROS. INC.
Twin City Iron Works
VULCAN IRON WORKS CO., (DENVER)
Washington Machinery Co.
Yaun Mfg. Co., Inc.

57 BUCKETS, HOISTING & SINKING—does not include Skips & Cages

Coeur d'Alene Hardware & Foundry Co.
Denver Equipment Co.
Hirsch Bros. Machy. Co.
Holmes & Bros., Inc. Robert
MACHINERY CENTER, INC.
Mayo Tunnel & Mine Equipment
Pollock Co., William B.
VULCAN IRON WORKS CO., (DENVER)
Yaun Mfg. Co., Inc.

58 BUCKETS, TRAMWAY & TROLLEY

Richards-Wilcox Mfg. Co.

59 BUCKET TEETH & WEAR - REPLACEMENT PARTS

Allied Steel & Tractor Products, Inc.
AMERICAN BRAKE SHOE CO. AMERICAN MANGANESE STEEL DIV.
AMERICAN BRAKE SHOE CO.
BLAW-KNOX CO.
BUCYRUS-ERIE CO.
Coast Mfg. & Supply Co.
Columbia Steel Casting Co., Inc.
Electric Steel Foundry Co.
Erie Strayer Co.
Farrell-Cheek Steel Co.
Frog, Switch & Mfg. Co.
H. & L. Tooth Co.
Hayward Co.
Industrial Brownhoist Corp.
Industrial Overlay Metals, Inc.
Kensington Steel Div., Poor & Co.
Ladish Co.
Manganese Steel Forge Co.
NATIONAL MALLEABLE & STEEL CASTINGS CO.
Owen Bucket Co.
Page Engineering Co.
Pettibone Mulliken Corp.
SAUERMAN BROS., INC.
Sorel Steel Foundries, Ltd.
Stroh Process Steel Co.
Stulz-Sickles Co.
Wellman Engineering Co. McDowell Enterprise.

60 BUILDINGS, PREFAB

Armco Drainage & Metal Products, Inc.
Arrowhead Steel Buildings, Inc.
Black, Sivalls & Bryson, Inc.
Butler Manufacturing Co.
Dresser-Ideco Co.
Inland Steel Products Co.
REPUBLIC STEEL CORP.
REPUBLIC STEEL CORP. TRUSCON STEEL DIV.
Steel-Bilt Construction Co.
Steelcraft Mfg. Co.

(BULLDOZERS & ANGLE DOZER BLADES—see Tractor Attachments)

61 BURNERS, OIL, GAS & COAL (for Heaters, Furnaces, Kilns, etc.)

Hauck Mfg. Co.
BABCOCK & WILCOX CO.

BURNERS, HAND TORCH & MOBILE (for Thawing, Weed Burning, etc.) — also see Car Thawers; does not include Welding & Cutting Equipment

Hauck Mfg. Co.

C

(CABLE — see Electrical Cable; Wire Rope)

(CABLEWAYS — see Aerial)

(CAGES, MINE HOIST — see Skips & Cages)

(CALCULATORS—see: Computing Machines; Drafting Equip.; Meters; Office Machines)

62 CAP LAMPS, CARBIDE

Geophysical Instrument & Supply Co.
Justrite Mfg. Co.

63 CAP LAMPS, ELECTRIC

Justrite Mfg. Co.
MINE SAFETY APPLIANCES CO.
NATIONAL MINE SERVICE CO.
Nife, Inc.
RAY-O-VAC CO., DIV. ELECTRIC STORAGE BATTERY CO.

64 CAP LAMP CARBIDE

Air Reduction Sales Co., Div. Air Reduction Co., Inc.
Geophysical Instrument & Supply Co.

65 CARBIDES, TUNGSTEN & OTHER HARD METALS (SINTERED, CEMENTED, ETC.)

Adamas Carbide Co.
Air Reduction Sales Co., Div. Air Reduction Co., Inc.
Airdox Cardox Products Co.
Allegheny Ludlum Steel Corp.
AMERICAN MANGANESE STEEL DIV., AMERICAN BRAKE SHOE CO.
Carbone Corp.
Firth Sterling Inc.
Haynes Stellite Co., Div. Union Carbide Corp.
Hoyland Steel Co., Inc.
Industrial Overlay Metals, Inc.
Kennametal Inc. Mining Tool Div.
Metal Carbides Corp.
Metallurgical Products Dept. General Electric Co.
Newcomer Products, Inc.
Sight Feed Generator Co.
Vascoloy-Ramet Corp.

66 CARS, COMMERCIAL RAILROAD

Ateco Div. Greenville Steel Car Co.
BALDWIN-LIMA-HAMILTON CORP., EDDYSTONE DIV.
Dominion Steel & Coal Corp., Ltd.
Easton Car & Construction Co.
Frank, M. K.
Gregg Co., Ltd.

67 CARS, MINE R.R.—also see specific types below

ACF Industries, Inc. American Car & Foundry Div.
BALDWIN-LIMA-HAMILTON CORP., EDDYSTONE DIV.
Bethlehem Pacific Coast Steel Corp.
BETHLEHEM STEEL CO., INC.
CARD IRON WORKS, C. S.
Coeur d'Alene Hardware & Foundry Co.
Denver Equipment Co.
DIFFERENTIAL STEEL CAR CO.
Dominion Steel & Coal Corp., Ltd.
Easton Car & Construction Co.
Enterprise Wheel & Car Corp.
Frank, M. K.
GENERAL AMERICAN TRANSPORTATION CORP.
Getman Brothers
Gibraltar Equipment & Mfg. Co.
Gregg Co. Ltd.
Helmick Foundry-Machine Co.
Hirsch Bros. Machy. Co.
Hockensmith Corp.
Irwin Sensenich Corp.
Kaiser Steel Corp., Fabricating Div.
Lake Shore, Inc., Lake Shore Engineering Div.
Mayo Tunnel & Mine Equipment
MAGOR CAR CORP.
Moran Engineering Co
Sanford-Day Iron Works, Inc.
Telluride Iron Works Co.
TREADWELL CO., M. H.
Watt Car & Wheel Co.

68 CARS, MINE R.R. AUTOMATIC DUMP

ACF Industries, Inc. American Car & Foundry Div.
Bethlehem Pacific Coast Steel Corp.
BETHLEHEM STEEL CO.
CARD IRON WORKS, C. S.
Coeur d'Alene Hardware & Foundry Co.
CONNELLSVILLE MFG. & MINE SUPPLY CO.
DIFFERENTIAL STEEL CAR CO.
Dominion Steel & Coal Corp., Ltd.
Easton Car & Construction Co.
Enterprise Wheel & Car Corp.
Frank, M. K.
Gregg Co., Ltd.
Hirsch Bros. Machy. Co.
Irwin Sensenich Corp.
Lake Shore, Inc. Lake Shore Engineering Div.
MAGOR CAR CORP.
Moran Engineering Co.
NATIONAL IRON CO.
Sanford-Day Iron Works, Inc.
TREADWELL CO., M. H.
Watt Car & Wheel Co.

69 CARS, MINE R.R., FIRE —also see Fire Fighting Equipment

Irwin Sensenich Corp.
MINE SAFETY APPLIANCES CO.
Watt Car & Wheel Co.

70 CARS, MINE R.R. HAND DUMP

ACF Industries, Inc. American Car & Foundry Div.
Bethlehem Pacific Coast Steel Corp.
BETHLEHEM STEEL CO., INC.
CARD IRON WORKS, C. S.
Coeur d'Alene Hardware & Foundry Co.
Denver Equipment Co.
DIFFERENTIAL STEEL CAR CO.
Dominion Steel & Coal Corp., Ltd.
Easton Car & Construction Co.
Enterprise Wheel & Car Corp.
Frank, M. K.
Gregg Co., Ltd.
Helmick Foundry-Machine Co.
Hirsch Bros. Machy. Co.
Hockensmith Corp.
Irwin Sensenich Corp.
Lake Shore, Inc. Lake Shore Engineering Div.
Mayo Tunnel & Mine Equipment
Moran Engineering Co.
Ogden Iron Works
Sanford-Day Iron Works, Inc.
TREADWELL CO., M. H.
Watt Car & Wheel Co.

71 CARS, MINE & INDUSTRIAL R.R., MAN & SPECIAL TYPES

ACF Industries, Inc. American Car & Foundry Div.
Atlas Car & Mfg. Co.
BALDWIN-LIMA-HAMILTON CORP., EDDYSTONE DIV.
Bethlehem Pacific Coast Steel Corp.
BETHLEHEM STEEL CO., INC.
CARD IRON WORKS, C. S.
Coeur d'Alene Hardware & Foundry Co.
CONNELLSVILLE MFG. & MINE SUPPLY CO.
DIFFERENTIAL STEEL CAR CO.
Dominion Steel & Coal Corp., Ltd.
Easton Car & Construction Co.
Enterprise Wheel & Car Corp.
Frank, M. K.
Getman Brothers
Gibraltar Equipment & Mfg. Co.
Gregg Co., Ltd.
Helmick Foundry-Machine Co.
Hirsch Bros. Machy. Co.
Hockensmith Corp.
Holmes & Bros., Inc. Robert
Irwin Sensenich Corp.
Kersey Mfg. Co., Inc.
Lake Shore, Inc. Lake Shore Engineering Div.
Lee-Norse Co.
MACHINERY CENTER INC.
Moran Engineering Co.
Ogden Iron Works
Prime Mover Co.
Sanford-Day Iron Works, Inc.
TREADWELL CO., M. H.
Watt Car & Wheel Co.
YUBA CONSOLIDATED INDUSTRIES, INC., YUBA MFG. DIV.

(CAR ACCESSORIES, MINE & COMMERCIAL R.R. — see below; also see: Track . . .; Rail . . .)

72 CAR (R.R.) BODIES

ACF Industries, Inc. American Car & Foundry Div.
BALDWIN-LIMA-HAMILTON CORP., EDDYSTONE DIV.
Gregg Co., Ltd.

73 CAR CAGERS & SPOTTERS—does not include Car Movers

CARD IRON WORKS, C. S.
CONNELLSVILLE MFG. & MINE SUPPLY CO.
Flood City Brass & Elec. Co.
Hirsch Bros. Machy. Co.
Holmes & Bros., Inc. Robert
Maschinenfabrik Rudolf Hausherr & Soehne, GmbH, c/o B. J. Nykerk Corp.
Nolan Co.
Roberts & Schaefer Co., Subsidiary of Thompson Starrett Co., Inc.
Sanford-Day Iron Works, Inc.
Schroeder Brothers Corp.
Stamler Corp., W. R.

74 CAR (R.R.) COUPLERS & DRAFT GEAR

CARD IRON WORKS, C. S.
DIFFERENTIAL STEEL CAR CO.
Duquesne Mine Supply Co.
Enterprise Wheel & Car Corp.
Frank, M. K.
Gregg Co., Ltd.
Irwin-Sensenich Corp.
Mayo Tunnel & Mine Equipment
Moran Engineering Co.
NATIONAL MALLEABLE & STEEL CASTINGS CO.
Ohio Brass Co.
Peerless Equipment, Div. Poor & Co.
Sanford-Day Iron Works, Inc.
Utility Mine Equipment Co.

75 CAR (R.R.) DERAILERS & RERAILERS & CHOCKS — does not include switchtype derailers; see Rail Switches

Aldon Co.
Duquesne Mine Supply Co.
Foster Co., L. B.
Gibraltar Equipment & Mfg. Co.
Frank, M. K.
Miners' Hardware Supply Co.
Nolan Co.
Pettibone Mulliken Corp.
Sanford-Day Iron Works, Inc.

76 CAR (& TRUCK) DUMPING DEVICES

Advance Car Mover Co., Inc.
CARD IRON WORKS, C. S.
Coeur d'Alene Hardware & Foundry Co.
CONNELLSVILLE MFG. & MINE SUPPLY CO.
DIFFERENTIAL STEEL CAR CO.
Dominion Steel & Coal Corp., Ltd.
Easton Car & Construction Co.
Frank, M. K.
Gallion Allsteel Body Co.
Heil Co.,, TEC Div.
Hercules Steel Products Co.
Holmes & Bros.,, Inc. Robert
Heyl & Patterson, Inc.
Industrial Brownhoist Corp.
Kanawha Mfg. Co.
Lake Shore Inc. Lake Shore Engineering
LINK-BELT CO.
McKiernan-Terry Corp.
McNALLY PITTSBURG MFG. CORP.
Moran Engineering Co.
Nolan Co.
Ottumwa Box Car Loader Co.
Roberts & Schaefer Co., Subsidiary of Thompson Starrett Co., Inc.
Rogers Iron Works Co.
Truck Engineering Corp.
Wellman Engineering Co. McDowell Enterprise

77 CAR (R.R.) MOVERS, HAND

Advance Car Mover Co., Inc.
Aldon Co.
Atlas Car & Mfg. Co.
Christian Engineers, J. D.
Foster Co., L. B.
Frank, M. K.

DODGE MFG. CORP.

DuPont de Nemours & Co., E. I.

Heyl & Patterson, Inc.

HEWITT-ROBINS, INC.

Gibraltar Equipment & Mfg. Co.
LINK-BELT CO.
McNALLY PITTSBURG MFG. CORP.

78 CAR (R.R.) MOVERS, SPECIAL TRACTOR TYPE

Atlas Car & Mfg. Co.
Easton Car & Construction Co.
Frank, M. K.
HOUGH CO., FRANK G.
LE TOURNEAU-WESTINGHOUSE CO.
Westinghouse Air Brake Co.
Whiting Corp.

79 CAR (R.R.) MOVERS, WINCH TYPE

Bartlett & Snow Co., C. O.
Bodinson Manufacturing Co., Inc.
Christian Engineers, J. D.
Clyde Iron Works, Inc.
CONNELLSVILLE MFG. & MINE SUPPLY CO.
Electro Lift, Inc.
Foster Co., L. B.
Frank, M. K.
HEWITT-ROBINS, INC.
Heyl & Patterson, Inc.
Holmes & Bros., Inc. Robert
JEFFREY MFG. CO.
JOY MFG. CO.
Lidgerwood Industries, Inc.
LINK-BELT CO.
McKiernan-Terry Corp.
McNALLY PITTSBURG MFG. CORP.
O.K. Machinery Div. John C. Motter Printing Press Co.
Sanford-Day Iron Works, Inc.
Silent Hoist & Crane Corp.
Stephens-Adamson Mfg. Co.
Stimmel Winch Co., Inc.
Superior-Lidgerwood-Mundy Corp.
VULCAN IRON WORKS CO., (DENVER)
Washington Machinery Co.
Webster Mfg., Inc.

80 CAR (R.R.) RETARDERS

Frank, M. K.
Heyl & Patterson, Inc.
Holmes & Bros., Inc. Robert
LINK-BELT CO.
McNALLY PITTSBURG MFG. CORP.
Miners' Hardware Supply Co.
Nolan Co.
Sanford-Day Iron Works, Inc.
Schroeder Brothers Corp.
Union Switch Signal Div., Westinghouse Air Brake Co.
Webster Mfg., Inc.

81 CAR SHAKERS

ALLIS-CHALMERS MFG. CO.
Frank, M. K.
HEWITT-ROBINS, INC.
Heyl & Patterson, Inc.
LINK-BELT CO.
Martin Engineering Co.
SIMPLICITY ENGINEERING CO.
Stephens-Adamson Mfg. Co.
Syntron Co.
Webster Mfg., Inc.

82 CAR (R.R.) TRANSFERS, PASSERS, ETC.

AMERICAN MINE DOOR CO.
Atlas Car & Mfg. Co.
CARD IRON WORKS, C. S.
Coeur d'Alene Hardware & Foundry Co.
Dominion Steel & Coal Corp. Ltd.
Easton Car & Construction Co.
Frank, M. K.
MACHINERY CENTER, INC.
Mayo Tunnel & Mine Equipment
Telluride Iron Works, Co.

83 CAR (R.R.) TRUCKS—also see Car Wheels

CARD IRON WORKS, C. S.
NATIONAL MALLEABLE & STEEL CASTINGS CO.
Sanford-Day Iron Works, Inc.

84 CAR (R.R.) TURNTABLES

Atlas Car & Mfg. Co.
Bethlehem Pacific Coast Steel Corp.
CARD IRON WORKS, C. S.
Dominion Steel & Coal Corp., Ltd.
Easton Car & Construction Co.
Foster Co., L. B.
Frank, M. K.
HARDINGE CO., INC.
Irwin-Sensenich Corp.
Mayo Tunnel & Mine Equipment
Whiting Corp.

85 CAR (& TRUCK) THAWERS

Hauck Mfg. Co.
Vulcan Electric Co.

86 CAR (& LOCOMOTIVE) WHEELS & AXLES

Alco Products, Inc.
AMERICAN BRAKE SHOE CO., AMERICAN MANGANESE STEEL DIV.
ACF Industries, Inc. American Car & Foundry Div.
Atlas Car & Mfg. Co.
BALDWIN - LIMA - HAMILTON CORP. STANDARD STEEL WORKS DIV.
BETHLEHEM STEEL CO.
Bethlehem Pacific Coast Steel Corp.
Canadian Locomotive Co., Ltd.
CARD IRON WORKS, C. S.
Coeur d'Alene Hardware & Foundry Co.
DIFFERENTIAL STEEL CAR CO.
Dominion Steel & Coal Corp., Ltd.
Easton Car & Construction Co.
Enterprise Wheel & Car Corp.
Farrell-Cheek Steel Co.
Frank, M. K.
Gibraltar Equipment & Mfg. Co.
Hockensmith Corp.
Ironton Engine Co.
Irwin-Sensenich Corp.
Kersey Mfg. Co., Inc.
Moran Engineering Co.
NATIONAL MALLEABLE & STEEL CASTINGS CO.
Rockwell Spring & Axle Co. Timken-Detroit Axle Div.
Rogers Iron Works Co.
Sanford-Day Iron Works, Inc.
Sterling Steel Casting Co.
TENNESSEE COAL & IRON DIV. U. S. STEEL CORP.
U. S. STEEL CORP. COLUMBIA-GENEVA STEEL DIV.
Watt Car & Wheel Co.

87 CAR WHEEL & GEAR PULLERS

Armstrong, Bray & Co.
Crane Puller Co.
Frank, M. K.
Owatonna Tool Co.
Snap-on-Tools Corp.
Templeton, Kenley & Co.

88 CASTING WHEELS, SMELTER

TREADWELL CO., M. H.
TRAYLOR ENGINEERING & MFG. CO.

89 CASTINGS, IRON (GRAY, MALLEABLE ETC.)

AMERICAN BRAKE SHOE CO.
ACF Industries, Inc. American Car & Foundry Div.
American Chain & Cable Co. Inc., Acco Malleable Casting Div.
Auto-Lite Battery Corp.
Badger Malleable & Mfg. Co.
Belle City Malleable Iron Co. Racine Steel Castings Co.
Bethlehem Foundry & Machine Co.
Bethlehem Pacific Coast Steel Corp.
BETHLEHEM STEEL CO., INC.
BLAW-KNOX CO.
Cadillac Malleable Iron Co.
Calumet Div. Calumet & Hecla, Inc.
CARD IRON WORKS, C. S.
Chain Belt Co.
Coeur d'Alene Hardware & Foundry Co.
CONTINENTAL GIN CO., INDUSTRIAL DIV.
Cooper-Bessemer Corp.
Davis Foundry & Machine Works
Eagle Iron Works
Eaton Mfg. Co.
Enterprise Wheel & Car Corp.
Farrel-Birmingham Co., Inc.
General Electric Co., Foundry Dept.
Georgia Iron Works Co.
Gibraltar Equipment & Mfg. Co.
Goyne Pump Co.
HARDINGE CO., INC.
Helmick Foundry-Machine Co.
HEWITT-ROBINS, INC.
Hockensmith Corp.
Irwin-Sensenich Corp.
JEFFREY MFG. CO.
Kanawha Mfg. Co.
KENNEDY-VAN SAUN MFG. & ENG. CORP.
Lake Shore, Inc. Lake Shore Engineering Div.
LINK-BELT CO.
McLANAHAN & STONE CORP.
Meeker Foundry Co.
Moline Malleable Iron Co.
NATIONAL IRON CO.
NATIONAL MALLEABLE & STEEL CASTINGS CO.
NORDBERG MFG. CO.
Ogden Iron Works
Prox Co., Inc., Frank
Sheppard Co., Inc., R. H.
Square D Co.
Rogers Iron Works Co.
St. Louis Malleable Casting Co.
Sanford-Day Iron Works, Inc.
Shrivers, & Co., T.
STEARNS ROGER MFG. CO.
Swett Iron Works, A. L.
Telluride Iron Works Co.
TREADWELL CO., M. H.
Troy Engine & Machine Co.
Union Chain & Mfg. Co.
U. S. Pipe & Foundry Co.
Washington Iron Works
Webster Mfg., Inc.
WESTINGHOUSE ELECTRIC CORP.
WHITE DIESEL ENGINE, DIV., WHITE MOTOR CO.
Wood's Sons Co., T. B.

90 CASTINGS, FERROUS ALLOYS

Alloy Steel Casting Co.
ACF Industries, Inc. American Car & Foundry Div.
Allegheny Ludlum Steel Corp.
AMERICAN BRAKE SHOE CO.
AMERICAN BRAKE SHOE CO. AMERICAN MANGANESE STEEL DIV.
American Chain & Cable Co., Inc. Acco Steel Casting Div.
Atlas Steel Casting Co.
Auto-Lite Battery Corp.
BABCOCK & WILCOX CO.
Belle City Malleable Iron Co. Racine Steel Castings Co.
Bethlehem Pacific Coast Steel Corp.
BETHLEHEM STEEL CO., INC.
Cadillac Malleable Iron Co.
Calumet Div. Calumet & Hecla, Inc.
Columbia Steel Casting Co., Inc.
Cooper Bessemer Corp.
Duriron Co., Inc.
Eagle Iron Works
Electric Steel Foundry Co.
Empire Steel Castings, Inc.
Enterprise Wheel & Car Corp.
Farrell-Cheek Steel Co.
GENERAL ELECTRIC CO., FOUNDRY DEPT.
Georgia Iron Works Co.
Gibraltar Equipment & Mfg. Co.
Goyne Pump Co.
Industrial Overlay Metals, Inc.
Jessop Steel Co.
Kanawha Mfg. Co.
Kensington Steel Co.
KW-DART TRUCK CO.
Lebanon Steel Foundry
Los Angeles Steel Casting Co.
McNALLY PITTSBURG MFG. CORP.
NATIONAL MALLEABLE & STEEL CASTINGS CO.
NATIONAL SUPPLY CO.
Ponberthy Mfg. Co.
Sawyer Belt Hook & Wedge Co., Inc.
STEARNS ROGER MFG. CO.
Taylor-Wharton Co. Div. Harsco Corp.
Thomas Foundries, Inc.
TREADWELL CO., M. H.
Troy Engine & Machine Co.
Washington Iron Works
WESTINGHOUSE ELECTRIC CORP.
WHITE DIESEL ENGINE, DIV. WHITE MOTOR CO.

91 CASTINGS, NONFERROUS

Alloy Steel Casting Co.
Aluminum Co. of America
AMERICAN BRAKE SHOE CO.
American Crucible Products Co.
Ampco Metal, Inc.
Belmont Smelting & Refining Works
Beryllium Corp.
Bethlehem Pacific Coast Steel Corp.
BETHLEHEM STEEL CO., INC.
Brass Foundry Co.
Bridgeport Brass Co.
Cadman Mfg. Co., A. W.
Electric Materials Co.
Enterprise Wheel & Car Corp.
Flood City Brass & Elec. Co.
GENERAL ELECTRIC CO., FOUNDRY DEPT.
Gibraltar Equipment & Mfg. Co.
Goyne Pump Co.
Haynes Stellite Co. Div. Union Carbide Corp.
Hoffman Bros. Drilling Co.
INTERNATIONAL NICKEL CO.
Johnson Bronze Co.
Leavitt Machine Co.
Lumen Bearing Co.
Mueller Brass Co.
National Lead Co.
Ogden Iron Works
Olds Alloy Co.
Penberthy Mfg. Co.
Permold Co.
Shriver & Co., T.
Sawyer Belt Hook & Wedge Co., Inc.
Spang & Co.
Star Brass Works
STOODY CO.
Titan Metal Mfg. Co.
TREADWELL CO., M. H.
Troy Engine & Machine Co.
West Virginia Armature Co.
WESTINGHOUSE ELECTRIC CORP.
Williams & Son, E. A.

92 CASTINGS, STEEL

Acme Machinery Co.
Allegheny Ludlum Steel Corp.
Alloy Steel & Metals Co.
AMERICAN BRAKE SHOE CO.
AMERICAN BRAKE SHOE CO., AMERICAN MANGANESE STEEL DIV.
American Chain & Cable Co., Inc.
AMERICAN STEEL FOUNDRIES
Atlas Steel Casting Co.
BABOCK & WILCOX CO.
BALDWIN - LIMA - HAMILTON CORP. STANDARD STEEL WORKS DIV.
Belle City Malleable Iron Co. Racine Steel Castings Co.
Bethlehem Pacific Coast Steel Corp.
BETHLEHEM STEEL CO., INC.
BIRDSBORO STEEL FOUNDRY & MACHINE CO.
BLAW-KNOX CO.
CARD IRON WORKS, C. S.
Columbia Steel Casting Co., Inc.
Duriron Co., Inc.
Electric Steel Foundry Co.
Empire Steel Castings, Inc.
FALK CORP.
Farrel-Birmingham Co., Inc.
Farrell-Cheek Steel Co.
Frog, Switch & Mfg. Co.
GENERAL ELECTRIC CO., FOUNDRY DEPT.
Gibraltar Equipment & Mfg. Co.
Jessop Steel Co.
KENNEDY-VAN SAUN MFG. & ENG. CORP.
Lebanon Steel Foundry
Los Angeles Steel Casting Co.
NATIONAL IRON CO.
NATIONAL MALLEABLE & STEEL CASTINGS CO.
Pettibone Mulliken Corp.
Sorel Steel Foundries, Ltd.
Sterling Steel Casting Co.
Stroh Process Steel Co.
Strong Steel Foundry Co.
Taylor-Wharton Co. Div. Harsco Corp.
Thomas Foundries, Inc.
TREADWELL CO., M. H.
U. S. STEEL CORP. COLUMBIA-GENEVA STEEL DIV.
Washington Iron Works
WESTINGHOUSE ELECTRIC CORP.

93 CHAIN, CAST & WELDED

AMERICAN BRAKE SHOE CO. AMERICAN MANGANESE STEEL DIV.
American Chain Div. American Chain & Cable Co., Inc.
Chain Belt Co.
Columbia Steel Casting Co., Inc.
Electric Steel Foundry Co.
Farrell-Cheek Steel Co.
Irwin-Sensenich Corp.
JEFFREY MFG. CO.
Kanawha Mfg. Co.
Kensington Steel Co.
LINK-BELT CO.
McNALLY PITTSBURG MFG. CORP.
Moline Malleable Iron Co.
Morse Chain Co.
NATIONAL MALLEABLE & STEEL CASTINGS CO.
Olds Alloy Co.
Page Engineering Co.
Paulsen-Webber Cordage Corp.
REPUBLIC STEEL CORP.
Ryerson & Son, Inc., Joseph T.
Taylor Chain Co. Inc., S. G.
Taylor-Wharton Co. Div. Harsco Corp.
Union Chain & Mfg. Co.

94 CHAIN, POWER TRANSMISSION

Atlas Chain & Mfg. Co.
Bartlett & Snow Co., C. O.
Browning Mfg. Co.
Chain Belt Co.
Christian Engineers, J. D.
CONTINENTAL GIN CO. INDUSTRIAL DIV.
Cullman Wheel Co.
Diamond Chain Co., Inc.
Dick Co., R. & J.

DODGE MFG. CORP.
JEFFREY MFG. CO.
LINK-BELT CO.
McNALLY PITTSBURG MFG. CORP.
Moline Malleable Iron Co.
Morse Chain Co., A Borg-Warner Industry
Olds Alloy Co.
Union Chain & Mfg. Co.
Whitney Chain Co.

95 CHAIN FITTINGS & ACCESSORIES

American Chain Div. American Chain & Cable Co., Inc.
AMERICAN HOIST & DERRICK CO.
Chain Belt Co.
Columbia Steel Casting Co., Inc.
Diamond Chain Co., Inc.
DODGE MFG. CO.
Electric Steel Foundry Co.
Farrell-Cheek Steel Co.
Hayes Steel Products, Ltd.
Interstate Drop Forge Co.
JEFFREY MFG. CO.
Kensington Div., Poor & Co.
Lebus Mfg. Co. Subsidiary of American Hoist & Derrick Co.
LINK-BELT CO.
Madasco Tackle Block Co.
Moline Malleable Iron Co.
Newhall Chain Forge & Iron Co.
Page Engineering Co.
Paulsen-Webber Cordage Corp.
REPUBLIC STEEL CORP.
Taylor Chain Co. Inc., S. G.
Taylor-Wharton Co. Div. Harsco Corp.
Union Chain & Mfg. Co.
Webb Co., Jervis B.

96 CHAIN SLINGS

AMERICAN BRAKE SHOE CO.
American Chain Div. American Chain & Cable Co., Inc.
Electric Steel Foundry Co.
Manning, Maxwell & Moore, Inc. Shaw Box Crane & Hoist Div.
McMillan's Sons, W. H.
Newhall Chain Forge & Iron Co.
Paulsen-Webber Cordage Corp.
REPUBLIC STEEL CORP.
Ryerson & Son, Inc., Joseph T.
Taylor Chain Co. Inc., S. G.

(CHAIN SPROCKETS — see Gears)

97 CHANGE ROOM EQUIPMENT

Moore Co.

98 CHEMICAL LABORATORY EQUIPMENT & SUPPLIES—does not include Chemicals; also see: Meters, Laboratory & Scientific Instruments other than . . . etc.

BALL BROTHERS RESEARCH CORP.
Bartlett & Snow Co., C. O.
Central Scientific Co.
Corning Glass Works
Engelhard Industries, Inc.
Fisher Scientific Co.
Jarrell-Ash Co.
Leeds & Northrup Co.
Snyder & Son, Inc., M. L.
Van Waters & Rogers, Inc.
VARIAN ASSOCIATES

99 CHEMICALS—also see: Flotation Reagents; Water Treatment Chemicals

ALLIED CHEMICAL CORP., SOLVAY PROCESS DIV.
Aluminum Co. of America
AMERICAN CYANAMID CO.
AMERICAN METAL CLIMAX INC., CLIMAX MOLYBDENUM CO. DIV.
American Potash & Chemical Co.
Apache Powder Co.
ARMOUR & CO.
ATLAS POWDER CO.
Baker Chemical Co., J. T.
BAKER & ADAMSON PRODUCTS, GENERAL CHEMICAL DIV., ALLIED CHEMICAL CORP.
Belmont Smelting & Refining Works, Inc.
Canadian Industries Ltd.
Carey Mfg. Co., Philip
Collier Carbon & Chemical Corp.
Commercial Solvent Corp.
DOW CHEMICAL CO.
DuPont de Nemours & Co., E. I.
DuPont de Nemours & Co., E. I. Explosives Dept.
Emery Industries, Inc.
Farbwerke Hoechst, A. G.
Fisher Scientific Co.
Food Machinery & Chemical Corp. Westvaco Mineral Products Div. Westvaco Chlor-Alkali Div.
Fuel Process Co.
General Mills, Inc.
Hagan Chemicals & Controls, Inc. Divisions: Calgon Co., Hall Laboratories
HERCULES POWDER CO.
Kaiser Aluminum & Chemical Sales, Inc.
Mallinckrodt Chemical Works
Marathon Corp., Div. American Can Co.
Metal & Thermit Corp.
Michigan Chemical Corp.
MINE & SMELTER SUPPLY CO., MFG. DIV.
Monsanto Chemical Co.
National Lead Co.
Oronite Chemical Co.
Pacific Lumber Co.
Pennsalt Chemicals Corp.
PHELPS DODGE REFINING CORP.
PHILADELPHIA QUARTZ CO.
Plumbing Products Div., Zurn Industries, Inc.
Reilly Tar & Chemical Corp.
Rohm & Haas Co.
Silicones Div., Union Carbide Corp.
Stein, Hall & Co., Inc.
Tennessee Corp.
TEXAS GULF SULPHUR CO.
Union Carbide Chemicals Co., Union Carbide Corp.
U.S. STEEL CORP., CHEMICAL SALES DIV.
U.S. RUBBER CO.
Van Waters & Rogers, Inc.
Wyandotte Chemicals Corp.

(CLASSIFIERS — see below; also see: Filters; Separators; Screens; Thickeners)

100 CLASSIFIERS, AIR, CENTRIFUGAL & SIMILAR —does not include Classifiers, Cyclone

Centrifugal & Mech. Industries, Inc.
Combustion Engineering, Inc. Raymond Div.
DORR-OLIVER, INC.
HARDINGE CO., INC.
KENNEDY-VAN SAUN MFG. & ENG. CORP.
Majac Inc.
Sharples Corp.
STURTEVANT MILL CO.
Telluride Iron Works Co.
Universal Road Machinery Co.

101 CLASSIFIERS, BELT

Acme Road Machinery Co., Inc.
Bodinson Manufacturing Co., Inc.
Denver Equipment Co.
HARDINGE CO., INC.
HEWITT-ROBINS, INC.
JEFFREY MFG. CO.
LINK-BELT CO.
MINE & SMELTER SUPPLY CO., MFG. DIV.
Rogers Iron Works Co.
Telluride Iron Works Co.
Washington Machinery Co.

102 CLASSIFIERS, BOWL

Acme Road Machinery Co., Inc.
DORR OLIVER, INC.
LINK-BELT CO.
Meckum Engineering, Inc.
Sharples Corp.

103 CLASSIFIERS, CYCLONE DRY

BUELL ENGINEERING CO.
Convair, Inc.
Drilling Accessory & Mfg. Co., Inc.
DUCON, INC.
Hazemag m. b. H.
KENNEDY-VAN SAUN MFG. & ENG. CORP.
Kirk & Blum Mfg. Co.
Patterson Foundry & Machine Co., Div. Ferro Corp.
STURTEVANT MILL CO.

104 CLASSIFIERS, CYCLONE, Wet

Atlantic Tank Corp.
Centrifugal & Mech. Industries, Inc.
Denver Equipment Co.
DORR OLIVER, INC.
Equipment Engineers Inc.
Georgia Iron Works Co.
Heyl & Patterson, Inc.
Kanawha Mfg. Co.
KENNEDY-VAN SAUN MFG. & ENG. CORP.
LINK-BELT CO.
McNALLY PITTSBURG MFG. CORP.
Prins & Associates, K.
Roberts & Schaefer Co., Subsidiary of Thompson Starrett Co., Inc.
Smith Engineering Works
Telluride Iron Works Co.

105 CLASSIFIERS, HYDRAULIC FLOW SETTLING

Cannon Concentrator Co.
DEISTER CONCENTRATOR CO.
Deister Machine Co.
Denver Equipment Co.
Eagle Iron Works
HARDINGE CO., INC.
Heyl & Patterson, Inc.
LINK-BELT CO.
Meckum Engineering, Inc.
MINE & SMELTER SUPPLY CO. MARCY MILL DIV.
Roberts & Schaefer Co., Subsidiary of Thompson Starrett Co., Inc.
Smith Engineering Works
WEMCO DIV. WESTERN MACHINERY CO.

106 CLASSIFIERS, HYDRAULIC CENTRIFUGAL (CENTRIFUGES, ET AL) —does not include Classifiers, Cyclone

Bird Machine Co.
Centrifugal & Mech. Industries, Inc.
MINE & SMELTER SUPPLY CO., MFG. DIV.
Condenser Service & Engineering Co.
DEISTER CONCENTRATOR CO.
Deister Machine Co.
Denver Equipment Co.
DOOR-OLIVER, INC.
Fahrenwald Co., A. W.
Heyl & Patterson, Inc.
LINK-BELT CO.
Meckum Engineering, Inc.
Sharples Corp.
WEMCO, DIV. WESTERN MACHINERY CO.

107 CLASSIFIERS, RAKE

Bodinson Manufacturing Co., Inc.
Denver Equipment Co.
DORR-OLIVER, INC.
HARDINGE CO., INC.
Hirsch Bros. Machy. Co.
LINK-BELT CO.
Lippmann Engineering Works, Inc.
Morse Bros. Machinery Co.
Washington Machinery Co.

108 CLASSIFIERS, SPIRAL-SCREW (MECHANICAL)

Acme Road Machinery Co., Inc.
Canadian Locomotive Co., Ltd.
Christian Engineers, J. D.
Denver Equipment Co.
Eagle Iron Works
Hirsch Bros. Machy. Co.
JEFFREY MFG. CO.
LINK-BELT CO.
Lippmann Engineering Works, Inc.
McLANAHAN & STONE CORP.
MINE & SMELTER SUPPLY CO., MARCY MILL DIV.
MINE & SMELTER SUPPLY CO., MFG. DIV.
Pioneer Engineering Div., Poor & Co. Inc.
Rogers Iron Works Co.
Sharples Corp.
Smith Engineering Works
STRAUB MFG. CO.
WEMCO, DIV., WESTERN MACHINERY CO.

109 CLOTH & FABRICS — also see: Bags; Brattice Cloth, Filter Cloth, Insulation Cloth; Tarpaulins, Ventilation Tubing; Wire Cloth

Albany Felt Co.
AMERICAN BRATTICE CLOTH CORP.
Cambridge Wire Cloth Co.
COLORADO FUEL & IRON CORP.
Daniels, Inc., C. R.
DuPont de Nemours & Co., Inc. E. I. Fabrics Div.
EIMCO CORP.
Filtration Engineers, Inc. Sub. of Amer. Machine & Metals, Inc.
Gatke Corp.
HEWITT-ROBINS, INC.
House & Sons, Inc. Chas. W.
Irvington Div. Minnesota Mining & Mfg. Co.
Johns-Manville
Ludlow-Saylor Wire Cloth Co.
Multi-Metal Wire Cloth Co., Inc.
NATIONAL FILTER MEDIA CORP.
Newark Wire Cloth Co.
Pendleton Woolen Mills
Safety Clothing & Equipment Co.
Snyder & Son, Inc., M. L.
Stanley Co., Inc., William W.
Turner Halsey Co.
TYLER CO., W. S.
Union Asbestos & Rubber Co.
U. S. RUBBER CO.
Wellington Sears Co.
Wheelabrator Corp.
WICKWIRE SPENCER STEEL DIV. COLORADO FUEL & IRON CORP.

(CLOTHING — see Safety Clothing)

(CLUTCHES, FLUID — see Drives, Fluid)

110 CLUTCHES, FRICTION

American Flexible Coupling Div. Zurn Industries, Inc.
Asbestos Mfg. Co.
Centric Clutch Co.
DODGE MFG. CORP.
Eaton Mfg. Co.
Fawick Airflex Co., Inc.
Gatke Corp.
JEFFREY MFG. CO.
LINK-BELT CO.
Marland One-Way Clutch Co.
Morse Chain Co. A Borg-Warner Industry
New Departure Div., General Motors Corp.
PORTER COMPANY, INC., H. K., THERMOID DIV.
Twin Disc Clutch Co.
Wellman Co., S. K.

111 COATINGS, ABRASION-RESISTANT, NON-METALLIC—does not include Linings & Claddings

Gates Engrg. Co.
Goodall Rubber Co.
GOODRICH INDUSTRIAL PRODUCTS CO., B. F.
GOODYEAR TIRE & RUBBER CO.
GOODYEAR TIRE & RUBBER CO., INDUSTRIAL PRODUCTS
Master Bronze Powder Co., Inc.
Metal & Thermit Corp.
Norton Co.
Permagile Corp. of America
PORTER COMPANY, INC., H. K. THERMOID DIV.
Quigley Co., Inc.
Reilly Tar & Chemical Corp.
Rust-Oleum Corp.
Sauereisen Cement Co.
Sherwin-Williams Co.
Slip-On, Inc.
STANDARD OIL CO. OF CALIF., WESTERN OPERATIONS, INC.
U. S. RUBBER CO.
WESTINGHOUSE ELECTRIC CORP.
Wilbur & Williams Co.
Zophar Mills, Inc.

112 COATINGS, CHEMICAL & CORROSION-RESISTANT, METALLIC—also see Metalizing; does not include Linings & Claddings

AMERCOAT CORP.
AMERICAN MANGANESE STEEL DIV., AMERICAN BRAKE SHOE CO.
Carboline Co.
GENERAL AMERICAN TRANSPORTATION CORP.
Haynes Stellite Co.
Industrial Overlay Metals, Inc.
Lincoln Electric Co.
Metal & Thermit Corp.
Metallizing Engineering Co.
Silicones Div., Union Carbide Corp.
WESTINGHOUSE ELECTRIC CORP.
Wilbur & Williams Co.

113 COATINGS, CHEMICAL & CORROSION-RESISTANT, NON-METALLIC —does not include: Linings & Claddings; Paints

ALLIED CHEMICAL CORP., SOLVAY PROCESS DIV.
AMERCOAT CORP.
ARMOUR CHEMICAL DIV.
Atlantic Refining Co.
Cabot, Inc., Samuel
Carboline Co.
Carbolineum Wood Preserving Co.
Carey Mfg. Co., Philip
Denver Equipment Co.
DuPont de Nemours & Co., E. I.
DuPont de Nemours & Co. E. I. Fabrics Div.
Eagle-Picher Co.
Foster Co., L. B.
Galigher Co.
Gates Engrg. Co.
Goodall Rubber Co.
GOODRICH INDUSTRIAL PRODUCTS CO., B. F.
GOODYEAR TIRE & RUBBER CO.
GOODYEAR TIRE & RUBBER CO. INDUSTRIAL PRODUCTS
Gulf Oil Corp.
Houghton & Co., E. F.
Irvington Div. Minnesota Mining & Mfg. Co.
Johns-Manville
Keystone Lubricating Co.
Koppers Co. Inc.
Luzerne Rubber Co.
Metal & Thermit Corp.
Minnesota Mining & Mfg. Co.
Monsanto Chemical Co.
National Carbon Co., Union Carbide Corp.
National Lead Co.
Norton Co.
Pennsalt Chemicals Corp.
Permagile Corp. of America
PHILADELPHIA QUARTZ CO.
PORTER COMPANY, INC., H. K. THERMOID DIV.
Quigley Co., Inc.
Reilly Tar & Chemical Corp.
Ruberoid Co.
Rust-Oleum Corp.
Sauereisen Cement Co.
Shell Oil Co.
Sika Chemical Corp.
Slip-On, Inc.
SOLVAY PROCESS DIV., ALLIED CHEMICAL & DYE CORP.
STANDARD OIL CO. OF CALIF., WESTERN OPERATIONS, INC.
Sun Oil Co.
TEXAS CO.
U. S. RUBBER CO.
Valvoline Oil Co., Div Ashland Oil & Refining Co.
Wilbur Williams Co.
WESTINGHOUSE ELECTRIC CORP.
Zophar Mills, Inc.

114 COMMUNICATIONS, AUDIBLE SIGNAL (BELL, BUZZER, HORN, ETC.)—also see below

Bristol Co.
Falcon Alarm Co., Inc.
Federal Sign & Signal Corp.
Femco, Inc.
General Equipment Mfg. Co.
Graybar Elec. Co., Inc.
Hose-McCann Telephone Co., Inc.
Lunkenheimer Co.
Patrick & Wilkins Co.
Talk-A-Phone Co.
Wheelco Instr. Div. Barber-Coleman Co.

115 COMMUNICATIONS, RADIO

Automatic Electric Co.
Elgin National Watch Co.
Federal Telephone & Radio Div. International Telephone and Telegraph Corp.
Femco, Inc.
Fisher Research Laboratory, Inc.
GENERAL ELECTRIC CO., COMMUNICATIONS PRODUCTS DEPT.
General Equipment & Mfg. Co.
Graybar Elec. Co., Inc.
INDUSTRIAL PHYSICS & ELECTRONICS CO.
Lafayette Radio Corp.
Motorola Communications Electronics, Inc.
NATIONAL MINE SERVICE CO.
Radio Corp. of America, Communications Products Dept.
Spartan Air Service
WESTINGHOUSE ELECTRIC CORP.

116 COMMUNICATIONS, TELEPHONE

Alphaduct Wire & Cable Co.
Ansonia Wire & Cable Co.
Automatic Electric Co.
Elgin National Watch Co.
Federal Telephone & Radio Div., International Telephone and Telegraph Corp.
Femco, Inc.
Graybar Elec. Co., Inc.
Hose-McCann Telephone Co.
INDUSTRIAL PHYSICS & ELECTRONICS CO.
NATIONAL MINE SERVICE CO.
PHELPS DODGE COPPER PRODUCTS CORP.
Union Switch Signal Div., Westinghouse Air Brake Co.
Wheeler Electronic Corp., Div. Sperry Rand Corp.

117 COMMUNICATIONS, TELEVISION

Diamond Power Specialty Corp.
Electronics Div., Diamond Power Specialty Corp.
Elgin National Watch Co.
General Equipment & Mfg. Co.
Graybar Elec. Co., Communication Products Dept.
Kin Tel, Div. of Cohu Electronics, Inc.
Motorola Communications & Electronics Inc.
PHELPS DODGE COPPER PRODUCTS CORP.
Taller & Cooper, Inc.

118 COMMUNICATIONS, VISUAL SIGNAL (LIGHTS, SEMAPHORE, ETC.)—also see above and Rail Signals; does not include Signs)

AMERICAN MINE DOOR CO.
CHEATHAM ELECTRIC SWITCHING DEVICE CO.
Federal Sign & Signal Corp.
General Equipment & Mfg. Co.
Graybar Elec. Co., Inc.
NATIONAL FILTER MEDIA CORP.
NACHOD U. S. SIGNAL CO.
Union Switch & Signal Div., Westinghouse Air Brake Co.

119 COMPUTING MACHINES—does not include slide rules (see Drafting Equip.)

Bristol Co.
Remington Rand Div. Sperry Rand Corp.

(CONCENTRATORS — See Separators & Concentrators including Electrostatic, Heavy Media, Jigs, Tables, Magnetic and Spiral)

120 CONCRETE ADDITIVES (DISPERSANTS, ANTI-FREEZE, ETC.)

Canadian Industries Ltd.
Dewey & Almy Chemical Div., W. R. Grace & Co.
DOW CHEMICAL CO.
HERCULES POWDER CO.
Heyl & Patterson, Inc.
Johns-Manville
Master Builders Co.
Monsanto Chemical Co.
Sika Chemical Corp.
Wyandotte Chemicals Corp.

121 CONCRETE GROUT PUMPS

Drilling Accessory & Mfg. Co., Inc.
GARDNER-DENVER CO.
Koehring Co.
Prehy Co.
Mayo Tunnel & Mine Equipment
Pickard Industries, Inc. Central Mine Supply Co., Div.
SPRAGUE & HENWOOD, INC.

122 CONCRETE (& similar material) PUMPS, SLINGERS & PLACERS

Air Placement Equip. Co.
Chain Belt Co.
CHICAGO PNEUMATIC TOOL CO.
Engineered Equipment, Inc.
Herold Mfg. Co.
Prehy Co.

123 CONCRETE SPRAYERS & BLOWERS

Air Placement Equip Co.
Cement Gun Co.
Engineered Equipment Inc.
Pickard Industries, Inc. Central Mine Supply Co., Div.
Prehy Co.
Sika Chemical Corp.

(CONDENSERS—see Coolers)

(CONSULTANTS—see: Contractors; Laboratory Service; also see p. 243)

124 CONTINUOUS MINERS & PLANERS—also see: Drills (Rock) Special Large; does not include Cutting Machines; for bits see Cutting Machine Bits

Coeur d'Alene Hardware & Foundry Co.
Compton, Inc.
GOODMAN MFG. CO.
JEFFREY MFG. CO.
JOY MFG. CO.
Lee-Norse Co.
NATIONAL MINE SERVICE CO.
Salem Tool Co.
Westfalia Lunen
Westinghouse Air Brake Co.
Wilcox Mfg. Co.

125 CONTRACTORS, AERIAL SURVEY (EXPLORATION, MAPPING, ETC.)

Abrams Aerial Survey Corp.
AERO SERVICE CORP.
Aero Service Corp. (Mid-Continent)
Aero Service Corp. de Venezuela, C. A.
Aero Service Corp. (Western)
African Surveys (Pty.), Ltd.
American Air Surveys, Inc.
Ammann Photogrammetric Engineers Inc., Jack
Canadian Aero Service Ltd.
Cummings Jr., & Associates, Robt. A.
Fairchild Aerial Surveys, Inc.
Hunting Technical & Exploration Services Ltd.
Laylander, Philip A.
Nuclear Exploration Co.
Resources Development Corp.
Spartan Air Services, Ltd.

126 CONTRACTORS, CONSTRUCTION, MINERAL PROCESSING PLANT

Bechtel Corp.
BLAW-KNOX CO.
Carpco Manufacturing, Inc.
Catalytic Construction Co.
Daniels Co. Contractors, Inc.
Elgin Corp.
Hack Engineering Co.
Heineken, Inc. W. P.
Industrial Engrg. & Constuction Co.
KAISER ENGINEERS
McDowell Co., Inc.
McKee & Co., Arthur G.
Minerals Engineering Co.
NATIONAL IRON CO.
Southwestern Engineering Co.
STEARNS ROGER MFG. CO.
Stone & Webster Engineering Co.
Telluride Iron Works Co.
Universal Dredge Mfg. Co.
Utah Construction Co.
Walvoord Inc., O. W.
WEMCO, DIV., WESTERN MACHINERY CO.
WESTERN-KNAPP ENGINEERING CO.
Winston Bros. Co.

127 CONTRACTORS, CONSTRUCTION, PIERS & WHARVES, ORE HANDLING, ET AL

DeLong Engineering Corp.
DRAVO CORP.
McDowell Co., Inc.
Southwestern Engineering Co.
Utah Construction Co.
WESTERN-KNAPP ENGINEERING CO.

128 CONTRACTORS, CONSTRUCTION, SHAFT & TUNNEL

Bechtel Corp.
BOYLES BROS. DRILLING CO. (UTAH)
Coal State Construction Co.
DRAVO CORP.
Elgin Corp.
Fitz Simons & Cornell Dredge & Dock Co.
Frazer Davis Construction Co.
Johnson Co., R. G.
KAISER ENGINEERS
McKenzie & Whittle
McKinney Drilling Co.
MOBILE DRILLING, INC.
Pennsylvania Drilling Co.
Shaft & Development Machines Inc.
Shaft Constructors, Inc.
Stone & Webster Engineering Co.
Utah Construction Co.
WESTERN-KNAPP ENGINEERING CO.
Winston Bros. Co.

129 CONTRACTORS, DESIGN, MINE

Bechtel Corp.
Chapman, Wood & Griswold
Hack Engineering Co.
Herold Mfg. Co.
Industrial Engrg. & Construction Co.
KAISER ENGINEERS
Menlo Research Laboratory
Southwestern Engineering Co.
STEARNS ROGER MFG. CO.
Stone & Webster Engineering Co.
Telluride Iron Works Co.
Universal Dredge Mfg. Co.
Utah Construction Co.
Walvoord, Inc., O. W.
WEMCO, DIV., WESTERN MACHINERY CO.
WESTERN-KNAPP ENGINEERING CO.
Winston Bros. Co.

130 CONTRACTORS, DESIGN MINERAL PROCESSING PLANT

Bartlett & Snow Co., C. O.
Bechtel Corp.
BLAW-KNOX CO.
Carpco Manufacturing Inc.
Catalytic Construction Co.
Daniels Co. Contractors, Inc.
Denver Equipment Co.
GOULD CO., GORDON I.
Hack Engineering Co.
Heineken, Inc. W. P.
KAISER ENGINEERS
KELLOGG CO., M. W.
McDowell Co., Inc.
McKee & Co., Arthur G.
Menlo Research Laboratory
Minerals Engineering Co.
Southwestern Engineering Co.
STEARNS ROGER MFG. CO.
Stone & Webster Engineering Co.
TREADWELL CO., M. H.
Universal Dredge Mfg. Co.
Utah Construction Co.
Vitro Corp. of America
Walvoord, Inc., O. W.
WEMCO, DIV., WESTERN MACHINERY CO.
WESTERN-KNAPP ENGINEERING CO.

131 CONTRACTORS, DRILLING (EXPLORATION)

Black Diamond Spade Co.
Booth Co.
BOYLES BROS. DRILLING CO., LTD.
BOYLES BROS. DRILLING CO. (UTAH)
Brosites Products Corp.
Carpco Manufacturing, Inc.
Chapman & Wood
GARDNER-DENVER CO.
Hoffman Bros. Drilling Co.
Hughes & Sons, Inc., L. J.
JOY MFG. CO.
Longyear Co., E. J.
Manu-Mine Research & Devel. Co.
McDonald Drilling Co., Inc.
McKinney Drilling Co.
Minerals Engineering Co.
MOBILE DRILLING & ENGINEERING INC., DIV. MOBILE DRILLING INC.
Mott Core Drilling Co.
Nuclear Exploration Co.
Pennsylvania Drilling Co.
SPRAGUE & HENWOOD, INC.
Utah Construction Co.
Winston Bros. Co.

132 CONTRACTORS, GEOLOGICAL SERVICE

Abrams Aerial Survey Corp.
AERO SERVICE CORP.
Aero Service Corp. (Mid-Continent)
Aero Service Corp. de Venezuela C. A.
Aero Service Corp. (Western)
African Surveys (Pty.) Ltd.

American Air Surveys, Inc.
Canadian Aero Service Ltd.
Chapman, Wood & Griswold
Engineers Syndicate, Ltd.
GOULD CO., GORDON I.
Hunting Technical & Exploration Services Ltd.
Laylander, Philip A.
McPhar Geophysics, Ltd.
MOBILE DRILLING, INC.
MOBILE DRILLING & ENGINEERING INC., DIV. MOBILE DRILLING INC.
Nuclear Exploration Co.
Pennsylvania Drilling Co.
Resources Development Corp.
Seismograph Service Corp.
Spartan Air Services, Ltd.

133 CONTRACTORS, GEOPHYSICAL SERVICE

AERO SERVICE CORP.
Aero Service Corp. (Mid-Continent)
Aero Service Corp. de Venezuela C. A.
Aero Service Corp. (Western)
African Surveys (Pty.) Ltd.
American Air Surveys, Inc.
Canadian Aero Service Ltd.
Engineers Syndicate, Ltd.
Fairchild Aerial Surveys, Inc.
GARDNER-DENVER CO.
Geophysical Instruments & Supply Co.
Heindrichs Exploration Co., G. O.
Hunting Technical & Exploration Services Ltd.
Lundberg Explorations, Ltd.
McPhar Geophysics, Ltd.
Nuclear Exploration Co.
Resources Development Corp.
Seismograph Service Corp.
Spartan Air Services, Ltd.

134 CONTRACTORS, GROUND SOLIDIFICATION & CEMENTATION

Mott Core Drilling Co.
Pennsylvania Drilling Co.

135 CONTRACTORS, MAPPING (TOPO)

AERO SERVICE CORP.
Aero Service Corp. (Mid-Continent)
Aero Service Corp. de Venezuela C. A.
Aero Service Corp. (Western)
African Surveys (Pty.) Ltd.
American Air Surveys, Inc.
Ammann Photogrammetric Engineers, Inc. Jack
Canadian Aero Service Ltd.
Chapman, Wood & Griswold
Cummings Jr., & Associates, Robt. A.
Fairchild Aerial Surveys, Inc.
Gurley, W. & L. E.
Hunting Technical & Exploration Services Ltd.
Spartan Air Services, Ltd.

136 CONTRACTORS, MINE & PROSPECT EXAMINATION & VALUATION—also see Consultants

Chapman, Wood & Griswold
GOULD CO., GORDON I.
Pennsylvania Drilling Co.

137 CONTRACTORS, MINING, DREDGING

Fitz Simons & Connell Dredge & Dock Co.
Hack Engineering Co.
Universal Dredge Mfg. Co.
Utah Construction Co.
Winston Bros. Co.

138 CONTRACTORS, MINING, OPEN PIT

Fitz Simons & Connell Dredge & Dock Co.
Foley Bros. Construction Co.
Hales Co., W. M.
Isbell Construction Co.
Minerals Engineering Co.
Southwestern Engineering Co.
Universal Dredge Mfg. Co.
Utah Construction Co.
Winston Bros. Co.

139 CONTRACTORS, MINING, STRIPPING

Fitz Simons & Connell Dredge & Dock Co.
Hales Co., W. M.
Isbell Construction Co.
Minerals Engineering Co.
Universal Dredge Mfg. Co.
Utah Construction Co.
Winston Bros. Co.

140 CONTRACTORS, MINING UNDERGROUND

BOYLES BROS. DRILLING CO. (UTAH)
Fitz Simons & Connell Dredge & Dock Co.
Frazier Davis Construction Co.
Hales Co., W. M.
Minerals Engineering Co.
Universal Dredge Mfg. Co.
Utah Construction Co.
Winston Bros. Co.

141 CONTROLS ELECTRICAL & ELECTRONIC (AUTOMATIC, REMOTE INDICATING, RECORDING, ETC.)—also see: Meters; Communications

ABC's Scale Div. McDowell Co., Inc.
Advance Relays Elgin National Watch Co., Electronics Div.
Aerofall Mills, Inc.
Allen-Bradley Co.
ALLIS-CHALMERS MFG. CO.
Allis Co., Louis
American Instrument Co., Inc.
American Rectifier Corp.
Arrow Hart & Hegeman Electric Co.
Assembly Products, Inc.
Auto-Lite Battery Corp.
Automatic Electric Co.
Automatic Switch Co.
Bailey Meter Co.
Barrett Haentjens & Co.
Beckman Instruments, Inc., Process Instruments Div.
Bin-Dicator Co.
Bristol Co.
B-I-F Industries, Inc.
Chatillon & Sons, John
CHEATHAM ELECTRIC SWITCHING DEVICE CO.
Clark Controller Co.
Consolidated Electrodynamics Corp.
Control Corp.
Convair
CURTISS-WRIGHT CORP., ELECTRONICS DIV.
Cutler-Hammer, Inc.
Dietz Co., Henry G.
Electric Controller & Mfg. Co. Div. Square D Co.
Electric Machinery Mfg. Co.
Electro Products Laboratories
Electronics Div., Diamond Power Specialty Corp.
Elgin National Watch Co.
Ensign Electric & Mfg. Co.
Erie Strayer Co.
FAIRBANKS, MORSE & CO.
Falcon Alarm Co., Inc.
Federal Pacific Electric Co.
Femco, Inc.
Fischer & Porter Co.
Foxboro Co.
Fuller Co.
GENERAL ELECTRIC CO. APPARATUS SALES DIV.
General Equipment & Mfg. Co.
Gerber Scientific Instrument Co.
Graybar Elec. Co., Inc.
Hagan Chemicals & Controls, Inc. Divisions: Calgon Co., Hall Laboratories
HARDINGE CO., INC.
Hart Mfg. Co.
Illinois Testing Laboratories, Inc.
INDUSTRIAL PHYSICS & ELECTRONICS CO.
INFILCO, INC.
Johnson Corp.
Kurz & Root Co.
Ledeen, Inc.
Leeds & Northrup Co.
MERRICK SCALE MFG. CO.
MINNEAPOLIS - HONEYWELL REGULATOR CO.
MINNEAPOLIS - HONEYWELL REGULATOR CO. BROWN INSTRUMENT DIV.
MINNEAPOLIS - HONEYWELL REGULATOR CO. INDUSTRIAL DIV.
MINNEAPOLIS - HONEYWELL REGULATOR CO. MICRO SWITCH DIV.
NACHOD & U. S. SIGNAL CO.
NATIONAL FILTER MEDIA CORP.
Norden-Ketay Corp.
Nuclear Research Corp.
Ohio Electric Mfg. Co.
Paragon Electric Co.
PERMUTIT CO., DIV. PFAUDLER PERMUTIT INC.
Philips Electronics, Inc. Instruments Div.
Pittsburgh Electrical & Machine Works
Preco, Inc.
Pyle-National Co.
Reliance Electric & Engineering Co.
Republic Flow Meters Co.
Revere Corp. of America
Richardson Scale Co.
Sangamo Electric Co.
Streeter-Amet Co.
Taller & Cooper, Inc.
Texas Instruments, Inc. Industrial Instrumentation Div.
Trombetta Solenoid Corp.
Union Switch & Signal Div., Westinghouse Air Brake Co.
Webb Co., Jervis B.
WESTINGHOUSE ELECTRIC CORP.
Weston Instruments, Div. Daystrom, Inc.
Wheico Instr. Div. Barber-Colman Co.

142 CONTROLS, HYDRAULIC & PNEUMATIC (AUTO. REMOTE, ETC,)—also see Meters

ABC's Scale Div. McDowell Co., Inc.
American Chain & Cable Co., Inc. Automotive & Aircraft Div.
American Instrument Co., Inc.
Automatic Switch Co.
Bailey Meter Co.
Barksdale Valves
Black, Sivalls & Bryson, Inc.
Bristol Co.
B-I-F Industries, Inc.
Cash Co., A. W.
Fischer & Porter Co.
Foxboro Co.
General Equipment & Mfg. Co.
Hagan Chemicals & Controls, Inc. Divisions: Calgon Co., Hall Laboratories
Hunt Son, Inc., C. B.
Industrial Physics & Electronics Co.
INFILCO, INC.
Jordan Corp., Div. OPW Corp.
Ledeen, Inc.
Leeds & Northrop Co.
MERRICK SCALE MFG. CO.
MINNEAPOLIS-HONEYWELL REGULATOR CO.
MINNEAPOLIS-HONEYWELL REGULATOR CO. BROWN INSTRUMENT DIV.
MINNEAPOLIS-HONEYWELL REGULATOR CO. INDUSTRIAL DIV.
Oilgear Co.
Owatonna Tool Co.
PERMUTIT CO., DIV. PFAUDLER PERMUTIT INC.
Pittsburgh Electrical & Machine Works
Republic Flow Meters Co.
Taller & Cooper, Inc.
U. S. Guage Div. American Machine & Metals, Inc.
Vickers Inc.
Western Instruments, Div. Daystrom, Inc.
Westinghouse Air Brake Co.
Westinghouse Air Brake Co. Ind. Products Div.
WESTINGHOUSE ELECTRIC CORP.

143 CONVERTERS, METAL (equipment not service)

ALLIS-CHALMERS MFG. CO.
TRAYLOR ENGINEERING & MFG. CO.
Telluride Iron Works Co.
TREADWELL CO., M. H.

144 CONVEYOR BELTING

Acme Road Machinery Co., Inc.
Acme Rubber Mfg. Co.
American Rubber Mfg. Co.
BARBER-GREENE CO.
Bonded Scale & Machine Co.
BOSTON WOVEN HOSE & RUBBER CO.
Cambridge Wire Cloth Co.
Carlyle Rubber Co.
Chicago Belting Div. Chicago-Allis Mfg. Corp.
COLORADO FUEL & IRON CORP.
Cooper-Bessemer Corp.
Daniels, Inc., C. R.
Dick Co., R. & J.
GATES RUBBER CO.
Gibraltar Equipment & Mfg. Co.
Goodall Rubber Co.
GOODRICH INDUSTRIAL PRODUCTS CO., B. F.
GOODYEAR TIRE & RUBBER CO.
HAMILTON RUBBER MFG. CORP.
HEWITT-ROBINS, INC.
Missouri Belting Co.
NATIONAL MINE SERVICE CO.
New York Belting & Packing Co.
New York Rubber Corp.
Northern Conveyor Co.
Philadelphia Belting Co.
Paltech Co.
Pickard Industries, Inc. Central Mine Supply Co., Div.
Pioneer Engineering Div., Poor & Co. Inc.
PORTER COMPANY, INC., H. K., THERMOID DIV.
RAYBESTOS-MANHATTAN, INC. MANHATTAN RUBBER DIV.
Republic Rubber Div. Lee Rubber & Tire Corp.
Sandvik Steel Inc. Steel Belt Conveyor Dept.
Scandinavia Belting Co.
Specialty Engineering Co.
U. S. RUBBER CO.
U. S. RUBBER CO. MECHANICAL GOODS DIV.
Webb Belting & Supply Co.
West Virginia Belt Repairs, Inc.
WICKWIRE SPENCER STEEL DIV. COLORADO FUEL & IRON CORP.

145 CONVEYOR BELTING FASTENERS

Acme Road Machinery Co., Inc.
American Rubber Mfg. Co.
Armstrong, Bray & Co.
Clipper Belt Lacer Co.
Crescent Belt Fastener Co., Inc.
Daniels, Inc., C. R.
Dick Co., R. & J.
FLEXIBLE STEEL LACING CO.
General Splice Corp.
Goodall Rubber Co.
HEWITT-ROBINS INC.
NATIONAL MINE SERVICE CO.
Northern Conveyor Co.
Pickard Industries, Inc. Central Mine Supply Co., Div.
RAYBESTOS-MANHATTAN, INC., MANHATTAN RUBBER DIV.
Sawyer Belt Hook & Wedge Co., Inc.
Talcott, Inc.
Webb Belting & Supply Co.
West Virginia Belt Repairs Inc.

146 CONVEYORS BELTING VULCANIZERS

FLEXIBLE STEEL LACING CO.
Food Machinery & Chemical Corp. Packing Equipment Div.
General Splice Corp.
Goodall Rubber Co.
GOODRICH INDUSTRIAL PRODUCTS Co., B. F.
Heintz Mfg. Co.
West Virginia Belt Repairs, Inc.

147 CONVEYORS, BELT—for belting alone, see Conveyor Belting

ABCs Scale Div. McDowell Co., Inc.
Acme Road Machinery Co., Inc.
American Conveyor Co.
American Rubber Mfg. Co.
Atlas Conveyor Co.
Bacon-Greene & Milroy
BALDWIN - LIMA - HAMILTON CORP. CONSTRUCTION EQUIPMENT DIV.
BARBER-GREENE CO.
Bartlett & Snow Co., C. O.
Bodinson Manufacturing Co., Inc.
Bonded Scale & Machine Co.
Boston Woven Hose & Rubber Co.
Cambridge Wire Cloth Co.
Carpco Manufacturing, Inc.
Chain Belt Co.
Christian Engineers, J. D.
Cincinnati Rubber Mfg. Co. Div. Thor Power Tool Co.
Columbus Conveyor Co.
Compton, Inc.
CONTINENTAL GIN CO. INDUSTRIAL DIV.
Conveyor Systems, Inc.
Davis Foundry & Machine Works
DIAMOND IRON WORKS DIV. GOODMAN MFG. CO.
Galigher Co.
GOODMAN MANUFACTURING CO.
Gruendler Crusher & Pulverizer Co.
Hack Engineering Co.
Hammermills, Inc.
Herold Mfg. Co.
HEWITT-ROBINS, INC.
Heyl & Patterson, Inc.
Hirsch Bros. Machy. Co.
Industrial Engrg. & Construction Co.
IOWA MFG. CO.
Irwin-Sensenick Corp.
JEFFREY MFG. CO.
JOY MFG. CO.
Kremser & Sons, Inc. Frank A.
Lake Shore, Inc. Lake Shore Engineering Div.
Lamson Corp.
LINK-BELT CO.
Lippmann Engineering Works, Inc.
Long Co.
Marsh Engineering Co., E. F.
Mayo Tunnel & Mine Equipment
McNally Pittsburg Mfg. Corp.
McNALLY PITTSBURG MFG. CORP.
MERRICK SCALE MFG. CO.
Morse Bros. Machinery Co.
Northern Conveyor Co.
Ogden Iron Works
Oliver Corp. A. B. Farquhar Div.
Philadelphia Belting Co.
Pioneer Engineering Div. Poor & Co. Inc.

Richardson Scale Co.
Rogers Iron Works Co.
Sandvik Steel Inc. Steel Belt Conveyor Dept.
Savage Co., W. J.
Specialty Engineering Co.
Stephens-Adamson Mfg. Co.
STURTEVANT MILL CO.
U. S. RUBBER CO. MECHANICAL GOODS DIV.
Universal Dredge Mfg. Co.
Universal Engineering Corp.
Universal Road Machinery Co.
Washington Machinery Co.
Webb Belting & Supply Co.
Webb Co., Jervis B.
Webster Mfg., Inc.
YUBA CONSOLIDATED INDUSTRIES, INC.

148 CONVEYORS, BELT, ACCESSORIES (Cleaners, Moldboards, etc.)

BARBER-GREENE CO.
HEWITT-ROBINS, INC.
LINK-BELT CO.
Osborn Mfg. Co.

149 CONVEYORS, BELT HOLDBACKS

AMERICAN PULLEY CO.
BARBER-GREENE CO.
Bonded Scale & Machine Co.
HEWITT-ROBINS, INC.
JEFFREY MFG. CO.
LINK-BELT CO.
Marland One-Way Clutch Co.
Stephens-Adamson Mfg. Co.

150 CONVEYORS, BELT, IDLERS & PULLEYS

Acme Road Machinery Co., Inc.
American Conveyor Co.
AMERICAN PULLEY CO.
Atlas Conveyor Co.
BARBER-GREENE CO.
Bartlett & Snow Co., C. O.
Bodinson Manufacturing Co., Inc.
Bonded Scale & Machine Co.
Chain Belt Co.
Christian Engineers, J. D.
Columbus Conveyor Co.
CONTINENTAL GIN CO. INDUSTRIAL DIV.
Davis Foundry & Machine Works.
Denver Equipment Co.
DIAMOND IRON WORKS DIV. GOODMAN MFG. CO.
Dick Co., R. & J.
DODGE MFG. CORP.
Food Machinery & Chemical Corp. Packing Equipment Div.
Galigher Co.
GOODMAN MANUFACTURING CO.
GOODYEAR TIRE & RUBBER CO.
Hack Engineering Co.
Hammermills, Inc.
HEWITT-ROBINS, INC.
Heyl & Patterson, Inc.
IOWA MFG. CO.
Irwin-Sensenick Corp.
JEFFREY MFG. CO.
JOY MFG. CO.
Kanawha Mfg. Co.
KENNEDY-VAN SAUN MFG. & ENG. CORP.
Kremser & Sons, Inc., Frank A.
Lamson Corp.
LINK-BELT CO.
Lippmann Engineering Works, Inc.
Long Co.
Marsh Engineering Co., E. F.
McNALLY PITTSBURG MFG. CORP.
Northern Conveyor Co.
Ogden Iron Works
Osborn Mfg. Co.
Pettibone Mulliken Corp.
Pickard Industries, Inc. Central Mine Supply Co., Div.
Pioneer Engineering Div. Poor & Co. Inc.
Ridge Equipment Co.
Rogers Iron Works Co.
Specialty Engineering Co.
Stephens-Adamson Mfg. Co.
U. S. RUBBER CO. MECHANICAL GOODS DIV.
Universal Engineering Corp.
Van Gorp Mfg., Inc.
Washington Machinery Co.
Universal Dredge Mfg. Co.
Washington Machinery Co.
Webb Belting & Supply Co.
Webb Co., Jervis B.
Webster Mfg., Inc.
West Virginia Belt Repairs, Inc.
Wood's Sons Co., T. B.
YUBA CONSOLIDATED INDUSTRIES, INC.

151 CONVEYORS, BELT, TAKE-UPS

Acme Road Machinery Co., Inc.
Atlas Conveyor Co.
BARBER-GREENE CO.
Bartlett & Snow Co., C. O.
Bodinson Manufacturing Co., Inc.
Bonded Scale & Machine Co.
Chain Belt Co.
Christian Engineers, J. D.
Columbus Conveyor Co.
CONNELLSVILLE MFG. & MINE SUPPLY CO.
CONTINENTAL GIN CO. INDUSTRIAL DIV.
DODGE MFG. CORP.
Fafnir Bearing Co.
Food Machinery & Chemical Corp. Packing Equipment Div.
GOODMAN MANUFACTURING CO.
Hack Engineering Co.
HEWITT-ROBINS, INC.
Heyl & Patterson, Inc.
Irwin-Sensenich, Inc.
JEFFREY MFG. CO.
JOY MFG. CO.
Kanawha Mfg. Co.
Kremser & Sons, Inc. Frank A.
LINK-BELT CO.
Lippman Engineering Works, Inc.
Lovejoy Flexible Coupling Co.
Marsh Engineering Co., E. F.
McNALLY PITTSBURG MFG. CORP.
Ogden Iron Works
Pickard Industries, Inc. Central Mine Supply Co., Div.
Pioneer Engineering Div. Poor & Co. Co., Inc.
Specialty Engineering Co.
Stephens-Adamson Mfg. Co.
Universal Dredge Mfg. Co.
Washington Machinery Co.
Webb Belting & Supply Co.
Webster Mfg., Inc.
YUBA CONSOLIDATED INDUSTRIES, INC.

152 CONVEYORS, BELT, TRIPPERS

Bartlett & Snow Co., C. O.
Bodinson Manufacturing Co., Inc.
Bonded Scale & Machine Co.
Chain Belt Co.
Christian Engineers, J. D.
Columbus Conveyor Co.
CONNELLSVILLE MFG. & MINE SUPPLY CO.
CONTINENTAL GIN CO. INDUSTRIAL DIV.
Hack Engineering Co.
HEWITT-ROBINS, INC.
Heyl & Patterson, Inc.
JEFFREY MFG. CO.
JOY MFG. CO.
Kanawha Mfg. Co.
Lamson Corp.
LINK-BELT CO.
Lippmann Engineering Works, Inc.
Marsh Engineering Co., E. F.
McNALLY PITTSBURG MFG. CORP.
Ogden Iron Works
Oliver Corp. A. B. Farquhar Div.
Stephens-Adamson Mfg. Co.
Universal Dredge Mfg. Co.
Webb Belting & Supply Co.
Webb Co., Jervis B.
Webster Mfg., Inc.

153 CONVEYORS (& ELEVATORS), BUCKET — does not include: Conveyors, Trolley; or digging type (see Loaders)

Acme Road Machinery Co., Inc.
American Conveyor Co.
Atlas Conveyor Co.
Bacon-Greene & Milroy
BARBER-GREENE CO.
B-1-F Industries, Inc.
Bonded Scale & Machine Co.
Butler Bin Co.
Butler Mfg. Co.
Carpco Manufacturing Inc.
Chain Belt Co.
Christian Engineers, J. D.
Columbus Conveyor Co.
CONTINENTAL GIN CO. INDUSTRIAL DIV.
Conveyor Systems, Inc.
Denver Equipment Co.
Engineered Equipment Inc.
Erie Strayer Co.
Fluor Products Co., Hartmann Div.
Galigher Co.
Gruendler Crusher & Pulverizer Co.
Hack Engineering Co.
Hapman Conveyors, Inc.
Heineken, Inc. W. P.
HEWITT-ROBINS, INC.
Hirsch Bros. Machy. Co.
Irwin-Sensenich Corp.
JEFFREY MFG. CO.
Johnson Co., C. S.
Kanawha Mfg. Co.
Kensington Steel Co.
Kremser & Sons, Inc., Frank A.
LINK-BELT CO.
Lippmann Engineering Works, Inc.
Marsh Engineering Co., E. F.
McNALLY PITTSBURG MFG. CORP.
Meckum Engineering Inc.
NATIONAL IRON CO.
Northern Conveyor Co.
Ogden Iron Works
Pickard Industries, Inc. Central Mine Supply Co., Div.
Pioneer Engineering Div. Poor & Co. Inc.
Ridge Equipment Co.
Rogers Iron Works Co.
Smith Engineering Works
Specialty Engineering Co.
Stephens-Adamson Mfg. Co.
STURTEVANT MILL CO.
Transport Trailers, Inc.
Union Chain & Mfg. Co.
Universal Dredge Mfg. Co.
Universal Road Machinery Co.
Savage Co., W. J.
Washington Machinery Co.
Webb Belting & Supply Co.
Webb Co., Jervis B.
Webster Mfg., Inc.
YUBA CONSOLIDATED INDUSTRIES, INC.

154 CONVEYORS, CHAIN (PACKAGE)

American Conveyor Co.
Bodinson Manufacturing Co., Inc.
Bonded Scale & Machine Co.
Chain Belt Co.
Christian Engineers, J. D
Compton, Inc.
Conveyor Systems, Inc.
Electric Steel Foundry Co.
Erie Strayer Co.
Food Machinery & Chemical Corp.
Hapman Conveyors, Inc.
Hirsch Bros. Machy. Co.
Irwin-Sensenich Corp.
JEFFREY MFG. CO.
Kanawha Mfg. Co.
Kremser & Sons, Inc., Frank A.
LINK-BELT CO.
Lippmann Engineering Works, Inc.
Long Co.
Morse Chain Co.
Northern Conveyor Co.
Oliver Corp. A. B. Farquhar Div.
Pickard Industries, Inc. Central Mine Supply Co., Div.
Richards-Wilcox Mfg. Co.
Specialty Engineering Co.
Stephens-Adamson Mfg. Co.
Union Chain & Mfg. Co.
Washington Machinery Co.
Watt Car & Wheel Co.
Webb Belting & Supply Co.
Webb Co., Jervis B.
Whitney Chain Co.

155 CONVEYORS, CHAIN (DRAG - SCRAPER), (BULK) — does not include: Dragline Scraper-Slusher; or digging type (see Loaders)

AMERICAN BRAKE SHOE CO. AMERICAN MANGANESE STEEL DIV.
American Conveyor Co.
American Well Works
Atlas Conveyor Co.
Bartlett & Snow Co., C. O.
Bethlehem Foundry & Machine Co.
Bodinson Manufacturing Co., Inc.
Bonded Scale & Machine Co.
Chain Belt Co.
Columbus Conveyor Co.
Compton, Inc.
CONTINENTAL GIN CO. INDUSTRIAL DIV.
Conveyor Systems, Inc.
Goodman Mfg. Co.
Hack Engineering Co.
Hapman Conveyors, Inc.
Herold Mfg. Co.
Hirsch Bros. Machy. Co.
Holmes & Bros., Inc., Robert
Industrial Engrg. & Construction Co.
Irwin-Sensenich Corp.
JEFFREY MFG. CO.
Kanawha Mfg. Co.
Kensington Steel Co.
Kremser & Sons, Inc. Frank A.
LINK-BELT CO.
Lippmann Engineering Works, Inc.
McNALLY PITTSBURG MFG. CORP.
Northern Conveyor Co.
Oliver Corp. A. B. Farquhar Div.
Ottumwa Box Car Loader Co.
Pettibone Mulliken Corp.
Prins & Associates K.
Roberts & Schaefer Co., Subsidiary of Thompson Starrett Co., Inc.
SAUERMAN BROS., INC.
Specialty Engineering Co.
Stephens-Adamson Mfg. Co.
Union Chain & Mfg. Co.
U. S. RUBBER CO. MECHANICAL GOODS DIV.
Universal Dredge Mfg. Co.
Webb Belting & Supply Co.
Webb Co., Jervis B.
Webster Mfg., Inc.

160 CONVEYORS, EXTENSIBLE

Industrial Engrg. & Construction Co.
Goodman Mfg. Co.
HEWITT-ROBINS, INC.
JEFFREY MFG. CO.
JOY MFG. CO.
LINK-BELT CO.

161 CONVEYORS, LOADING BOOM & STACKER — does not include: small digging type (see Loaders); or Cranes, Overhead Traveling Gantry, Bridge, Monorail, Etc.

BARBER-GREENE CO.
Bartlett & Snow Co., C. O.
Bonded Scale & Machine Co.
Hack Engineering Co.
Helmick Foundry-Machine Co.
HEWITT-ROBINS, INC.
JEFFREY MFG. CO.
LINK-BELT CO.
Pioneer Engineering Div., Poor & Co. Inc.
Rogers Iron Works Co.
Stephens-Adamson Mfg. Co.
STRAUB MFG. CO.
TREADWELL CO., M. H.
Universal Dredge Mfg. Co.
Webb Co., Jervis B.

162 CONVEYORS, MOBILE (including Self-propelled) —does not include digging type (see Loaders)

BARBER-GREENE CO.
Bonded Scale & Machine Co.
CONTINENTAL GIN CO. INDUSTRIAL DIV.
Hack Engineering Co.
HEWITT-ROBINS, INC.
Irwin-Sesenich Corp.
Kremser & Sons, Inc. Frank A.
LINK-BELT CO.
Lippmann Engineering Works, Inc.
Long Co.
Northern Conveyor Co.
STRAUB MFG. CO.
Universal Dredge Mfg. Co.
Webb Co., Jervis B.

163 CONVEYORS MOVABLE, also see Conveyors, Mobile; does not include digging type (see Loaders)

American Conveyor Co.
AMERICAN PULLEY CO.
BALDWIN - LIMA - HAMILTON CORP. CONSTRUCTION EQUIPMENT DIV.
BARBER-GREENE CO.
Bonded Scale & Machine Co.
Carrier Conveyor Corp.
Chain Belt Co.
CONTINENTAL GIN CO. INDUSTRIAL DIV.
Food Machinery & Chemical Corp. Packing Equipment Div.
Pettibone Mulliken Corp.
Hack Engineering Co.
Herold Mfg. Co.
HEWITT-ROBINS, INC.
Industrial Engrg. & Construction Co.
Irwin-Sesenich Corp.
Pettibone Mulliken Corp.
JOY MFG. CO.
KENNEDY-VAN SAUN MFG. & ENG. CORP.
Kremser & Sons, Inc. Frank A.
LINK-BELT CO.
Lippmann Engineering Works, Inc.
Marsh Engineering Co., E. F.
Oliver Corp.
Oliver Corp. A. B. Farquhar Div.
Ottumwa Box Car Loader Co.
Richards-Wilcox Mfg. Co.
Rogers Iron Works Co.
Specialty Engineering Co.
Stephens-Adamson Mfg. Co.
STRAUB MFG. CO.
Universal Dredge Mfg. Co.
Webb Belting & Supply Co.
Wilcox Mfg. Co.

164 CONVEYORS, PAN & APRON

Acme Road Machinery Co., Inc.
AMERICAN BRAKE SHOE CO. AMERICAN MANGANESE STEEL DIV.
American Conveyor Co.
Bartlett & Snow Co., C. O.
Bodinson Manufacturing Co., Inc.
Bonded Scale & Machine Co.
Carrier Conveyor Corp.
Chain Belt Co.
Christian Engineers, J. D.
Columbus Conveyor Co.
CONNELLSVILLE MFG. & MINE SUPPLY CO.
CONTINENTAL GIN CO. INDUSTRIAL DIV.
Conveyor Systems, Inc.
Denver Equipment Co.
Diamond Iron Works Div. Goodman Mfg. Co.
Fluor Products Co., Hartmann Div.
Food Machinery & Chemical Corp. Packing Equipment Div.
Gruendler Crusher & Pulverizer Co.
Hack Engineering Co.
Hapman Conveyors Inc.
Helmick Foundry-Machine Co.
HENDRICK MFG. CO.
Herold Mfg. Co.
HEWITT-ROBINS, INC.
Heyl & Patterson Inc.
Hirsch Bros. Machy. Co.
Industrial Engrg. & Construction Co.
IOWA MFG. CO.
JEFFREY MFG. CO.
JOY MFG. CO.
Kanawha Mfg. Co.
KENNEDY-VAN SAUN MFG. & ENG. CORP.
Kremser & Sons, Inc. Frank A.
LINK-BELT CO.
Lippmann Engineering Works, Inc.
Marsh Engineering Co., E. F.
Prins & Associates, K.
Lamson Corp.
MACHINERY CENTER, INC.
McNALLY PITTSBURG MFG. CORP.
NATIONAL IRON CO.
Pioneer Engineering Div. Poor & Co. Inc.
Holmes & Bros., Inc. Robert
Ogden Iron Works
Pettibone Mulliken Corp.
Roberts & Schaefer Co., Subsidiary of Thompson Starrett Co., Inc.
Rogers Iron Works Co.
SIMPLICITY ENGINEERING CO.
Simplicity System Co.
Smith Engineering Works
Sorel Steel Foundries, Ltd.
Specialty Engineering Co.
Stephens-Adamson Mfg. Co.
STRAUB MFG. CO.
Taylor-Wharton Co. Div. Harsco Corp.
Telluride Iron Works Co.
Union Chain & Mfg. Co.
Universal Dredge Mfg. Co.
Webb Belting & Supply Co.
Webb Co., Jervis B.
Webster Mfg., Inc.

165 CONVEYORS, PNEUMATIC

Allen-Sherman-Hoff Co.
Cleveland Vibrator Co.
Convair, Inc.
GENERAL AMERICAN TRANSPORTATION CO.
GRUEDLER CRUSHER & PULVERIZER CO.
Fluor Products Co., Hartmann Div.
FULLER CO., SUBSIDIARY GENERAL AMERICAN TRANSPORTATION CORP.
Hack Engineering Co.
Hapman Conveyors, Inc.
Lamson Corp.
Metals Disintegrating Co., Inc. Pulverizing Machinery Div.
Robinson Air-Activated Conveyor Systems
Specialty Engineering Co.
Spencer Turbine Co.
Universal Dredge Mfg. Co.
U. S. Hoffman Machinery Corp., Air Appliance Div.

166 CONVEYORS, ROLLER, GRAVITY & POWERED (PACKAGED)

American Conveyor Co.
Bonded Scale & Machine Co.
Conveyor Systems, Inc.
Food Machinery & Chemical Corp. Packing Equipment Div.
Hapman Conveyors, Inc.
Lamson Corp.
LINK-BELT CO.
Lippmann Engineering Works, Inc.
Oliver Corp. A. B. Farquhar Div.
Richards-Wilcox Mfg. Co.
Specialty Engineering Co.
Webb Belting & Supply Co.

167 CONVEYORS, SCREW OR SPIRAL

Atlas Conveyor Co.
Bartlet & Snow Co., C. O.
Bethlehem Foundry & Machine Co.
Bonded Scale & Machine Co.
Butler Bin Co.
Butler Mfg. Co.
Cambridge Wire Cloth Co.
Carpco Manufacturing Inc.
Central Mine Equipment Co.
Chain Belt Co.
Christian Engineers, J. D.
Coeur d'Alene Hardware & Foundry Co.
Columbus Conveyor Co.
CONTINENTAL GIN CO. INDUSTRIAL DIV.
Engineered Equipment Inc.
Erie Strayer Co.
Fluor Products Co., Hartmann Div.
Food Machinery & Chemical Corp. Packing Equipment Div.
Hack Engineering Co.
Hapman Conveyors, Inc.
Hirsch Bros. Machy, Co.
Holmes & Bros., Inc. Robert
JEFFREY MFG. CO.
Johnson Co., C. S.
KENNEDY-VAN SAUN MFG. & ENG. CORP.
LINK-BELT CO.
McNALLY PITTSBURG MFG. CORP.
Meckum Engineering, Inc.
Northern Conveyor Co.
Pickard Industries, Inc. Central Mine Supply Co., Div.
Pioneer Engineering Div., Poor & Co. Inc.
Richardson Scale Co.
Roberts & Schaefer Co., Subsidiary of Thompson Starrett Co., Inc.
Salem Tool Co.
Specialty Engineering Co.
STURTEVANT MILL CO.
Universal Dredge Mfg. Co.
Washington Machinery Co.
Webb Belting & Suply Co.
Webster Mfg., Inc.

168 CONVEYORS SECTIONAL PREFAB — does not include Conveyors, Movable

Acme Road Machinery Co., Inc.
Atlas Conveyor Co.
BARBER-GREENE CO.
Bonded Scale & Machine Co.
CONNELLSVILLE MFG. & MINE SUPPLY CO.
CONTINENTAL GIN CO. INDUSTRIAL DIV.
Gruendler Crusher & Pulverizer Co.
Hack Engineering Co.
Hapman Conveyors, Inc.
HEWITT-ROBINS, INC.
Irwin-Sensenich Corp.
JEFFREY MFG. CO.
JOY MFG. CO.
Kremser & Sons, Inc. Frank A.
Lamson Corp.
LINK-BELT CO.
Lippmann Engineering Works, Inc.
Marsh Engineering Co., E. F.
Oliver Corp. A. B. Farquhar Div.
Pioneer Engineering Div., Poor & Co. Inc.
Rogers Iron Works Co.
Specialty Engineering Co.
Stephens-Adamson Mfg. Co.
STRAUB MFG. CO.
Universal Dredge Mfg. Co.
Watt Car & Wheel Co.
Webb Belting & Suply Co
Webb Co., Jervis B.

169 CONVEYORS, SHAKING & VIBRATING—also see Feeders

Ajax Flexible Coupling Co.
Atlas Conveyor Co.
Branford Co.
Carpco Manufacturing, Inc.
Carrier Conveyor Corp.
Chain Belt Co.
Cleveland Vibrator Co.
Conveyor Systems, Inc.
DIESEL ENERGY CORP.
DRAVO CORP.
Goodman Mfg. Co.
Hack Engineering Co.
Herold Mfg. Co.
HEWITT-ROBINS, INC.
Heyl & Patterson, Inc.
Industrial Engrg. & Construction Co.
JEFFREY MFG. CO.
Kanawha Mfg. Co.
KENNEDY-VAN SAUN MFG. & ENG. CORP.
Lecco Machinery & Engineering Co.
LINK-BELT CO.
MINE & SMELTER SUPPLY CO.
Overstrom & Sons, Inc.
Richardson Scale Co.
Ridge Equipment Co.
SIMPLICITY ENGINEERING CO.
Specialty Engineering Co.
Stephens-Adamson Mfg. Co.
Syntron Co.
Universal Dredge Mfg. Co.
Washington Machinery Co.
Webb Belting & Supply Co.

170 CONVEYORS, TROLLEY —does not include aerial Cableways

Conveyor Systems, Inc.
Eriez Mfg. Co.
Hapman Conveyors, Inc.
Lamson Corp.
LINK-BELT CO.
Louden Machinery Co.
Oliver Corp.
Richards-Wilcox Mfg. Co.
Shepard Niles Crane & Hoist Corp.
Specialty Engineering Co.
Webb Co., Jervis B.
WICKWIRE SPENCER STEEL DIV. COLORADO FUEL & IRON CORP.

171 COOLERS (& CONDENSERS), COOLING TOWERS, LIQUID & GAS PROCESS—does not include Air Compressor Aftercoolers

Alco Products, Inc.
ALLIS-CHALMERS MFG. CO.
American Standard Industrial Div.
Canadian Locomotive Co., Ltd.
Carrier Corp.
Condenser Service & Engineering Co.
Curtis Manufacturing Co.
Foster Wheeler Corp.
Lille-Hoffmann Cooling Towers, Inc.
Marley Co.
Ogden Iron Works
Process Engineering, Inc.
Ready Power Co.
Southwestern Engineering Co.
WESTINGHOUSE ELECTRIC CORP.
Wheeler Mfg. Co., C. H.
Windeler Co., Ltd., George
Yaun Mfg. Co., Inc.
YUBA CONSOLIDATED INDUSTRIES, INC.

(CORE BARRELS—see Drills)

(COUPLERS, MINE CAR—see Car Couplers)

(COUPLINGS — see below; also see: Drill Rod; Pipe Fittings)

(COUPLINGS, MECHANICAL POWER TRANSMISSION— see below; also see: Clutches; Drives; Hubs)

172 COOLERS, SOLIDS

ALLIS-CHALMERS MFG. CO.
Bartlett & Snow Co., C. O.
Carrier Conveyor Corp.
Christian Engineers, J. D.
FULLER CO., SUBSIDIARY GATT
GENERAL AMERICAN TRANSPORTA- CORP. LOUISVILLE DRYER DIV.
HARDINGE CO., INC.
Heineken, Inc. W. P.
KENNEDY-VAN SAUN MFG. & ENG. CORP.
LINK-BELT CO.
NORDBERG MFG. CO.
SMIDTH & CO., F. L.
Standard Steel Corp.
STEARNS ROGER MFG. CO.
TRAYLOR ENGINEERING & MFG. CO.
VULCAN IRON WORKS
WESTERN PRECIPITATION CORP.
Yaun Mfg. Co., Inc.
YUBA CONSOLIDATED INDUSTRIES, INC.

173 COUPLINGS, M. P. T., FLEXIBLE

Ajax Flexible Coupling Co.
Arrowhead Products Div. Federal-Mogul-Bower, Bearings Inc.
Brown, Inc., David
Browning Mfg. Co.
Chain Belt Co.
CONTINENTAL GIN CO., INDUSTRIAL DIV.
Cullman Wheel Co.
Diamond Chain Co., Inc.
DODGE MFG. CORP.
Elliott Co.
F. A. B. Mfg. Co.
FALK CORP.
Farrel-Birmingham Co., Inc.
Foote Bros. Gear & Machine Corp.
HEWITT-ROBINS, INC.
JEFFREY MFG. CO.
Koppers Co., Inc. Metal Prod. Div.
LINK-BELT CO.
Lovejoy Flexible Coupling Co.
Maryland One-Way Clutch Co.
Mechanical Power Transmission Div., Zurn Industries, Inc.
Morse Chain Co. A Borg-Warner Industry
PHILADELPHIA GEAR CORP.
Poole Foundry & Machine Co.
Stimmel Winch Co., Inc.
Stratoflex, Inc.
Thomas Flexible Coupling Co.
Waldron Corp., John
Weatherhead Co. Fort Wayne Div.
Western Gear Corp.
Whitney Chain Co.
Wood's Sons Co., T. B.

174 COUPLINGS, M. P. T., RIGID

Arrowhead Products Div., Federal-Mogul-Bower, Bearings, Inc.
Browning Mfg. Co.
CONTINENTAL GIN CO., INDUSTRIAL DIV.
Cullman Wheel Co.
Dixon Valve & Coupling Co.
DODGE MFG. CORP.
Farrel-Birmingham Co., Inc.
LINK-BELT CO.
Lincoln Engineering Co., Div. McNeil Machine & Engineering Co.
Lovejoy Flexible Coupling Co.
Mechanical Power Transmission, Div. Zurn Industries, Ltd.
Mueller Brass Co.

175 CRANES, JIB (OVER 10-TON)

CATERPILLAR TRACTOR CO.
CLARK EQUIPMENT CO. CONSTRUCTION MACHINERY DIV.
Manning, Maxwell & Moore, Inc. Shaw Box Crane & Hoist Div.
Orton Crane & Shovel Co.
Shepard Niles Crane & Hoist Corp.
Specialty Engineering Co.
Wellman Engineering Co. McDowell Enterprise
Whiting Corp.

176 CRANES, JIB & DERRICK (UNDER 10-TON LIFT)

American Chain & Cable Co., Inc. Wright Hoist Div.
AMERICAN HOIST & DERRICK CO.
Anthony Co.
Chisholm-Moore Hoist Div. Columbus McKinnon Chain Corp.
Cleveland Crane & Engrg. Co.
Clyde Iron Works, Inc.
Hack Engineering Co.
Harrington Co.
Louden Machinery Co.
Manning, Maxwell & Moore, Inc. Shaw Box Crane & Hoist Div.
Orton Crane & Shovel Co.
Pitman Mfg. Co.
Reading Crane & Hoist Corp.
Richards-Wilcox Mfg. Co.
Round & Son, Inc., David
Shepard Niles Crane & Hoist Corp.
Silent Hoist & Crane Corp.
Stanco Mfg. & Sales, Inc.
Universal Dredge Mfg. Co.
Wellman Engineering Co. McDowell Enterprise
Westinghouse Air Brake Co.

177 CRANES, OVERHEAD TRAVELING, GANTRY, BRIDGE, MONORAIL, ETC.

American Chain & Cable Co., Inc. Wright Hoist Div.
AMERICAN HOIST & DERRICK CO.
Chisholm-Moore Hoist Div. Columbus McKinnon Chain Corp.
Cleveland Crane & Engrg. Co.
Clyde Iron Works, Inc.
Conco Engineering Works
Detroit Hoist & Machine Co.
DRAVO CORP.
Forker Corp.
Hack Engineering Co.
HARNISCHFEGER CORP.
Harrington Co.
Heyl & Patterson, Inc.
Industrial Brownhoist Corp.

Kaiser Steel Corp., Fabricating Div.
Lakeside Bridge & Steel Co.
Louden Machinery Co.
Manning, Maxwell & Moore, Inc. Shaw Box Crane & Hoist Div.
McKiernan-Terry Corp.
Pacific Coast Engineering Co.
Reading Crane & Hoist Corp.
Richards-Wilcox Mfg. Co.
Robbins & Myers, Inc., Hoist & Crane Div.
Round & Sons, Inc., David
Shepard Niles Crane & Hoist Corp.
Specialty Engineering Co.
STEARNS ROGER MFG. CO.
Universal Dredge Mfg. Co.
Washington Iron Works
Webb Co., Jervis B.
Wellman Engineering Co. McDowell Enterprise
Whiting Corp.
Wiley Mfg. Co.
YUBA CONSOLIDATED INDUSTRIES, INC., YUBA MFG. DIV.

178 CRANES, REVOLVING DERRICK, CRAWLER, LOCOMOTIVE & WHEELED

AMERICAN HOIST & DERRICK CO.
Anthony Co.
AUSTIN-WESTERN CONSTRUCTION EQUIPMENT DIV. BALDWIN-LIMA-HAMILTON CORP.
BALDWIN - LIMA - HAMILTON CORP. CONSTRUCTION EQUIPMENT DIV.
Bay City Shovels, Inc.
BUCYRUS-ERIE CO.
Clyde Iron Works, Inc.
Gar Wood Industries, Inc.
HARNISCHFEGER CORP.
Hyster Co.
Industrial Brownhoist Corp.
Insley Manufacturing Corp.
Lakeside Bridge & Steel Co.
Koehring Div. of Koehring Co.
Link-Belt Speeder Corp.
MANITOWOC ENGINEERING CORP.
MARION POWER SHOVEL CO.
Maxi Corp.
NORTHWEST ENGINEERING CO.
Ohio Locomotive Crane Co.
Orton Crane & Shovel Co.
Quick-Way Truck Shovel Co.
Schield Bantam Co.
Silent Hoist & Crane Corp.
Thew Shovel Co.
Unit Crane & Shovel Corp.
Locomotive Crane Div., Wellman Engineering Co.

179 CRANES, REVOLVING DERRICK, STATIONARY (OVER 10-TON)

AMERICAN HOIST & DERRICK CO.
Clyde Iron Works, Inc.
Conco Engineering Works
Insley Manufacturing Corp.
Lakeside Bridge & Steel Co.
NORTHWEST ENGINEERING CO.
Orton Crane & Shovel Co.
Shepard Niles Crane & Hoist Corp.
Thew Shovel Co.
Unit Crane & Shovel Corp.
Wellman Engineering Co.
Wiley Mfg. Co.

180 CRANKSHAFTS, DIESEL ENGINE

Ladish Co.
Marco Inc.

181 CRUSHERS, CONE

Acme Road Machinery Co., Inc.
ALLIS-CHALMERS MFG. CO.
Fahrenwald Co., A. W.
KENNEDY-VAN SAUN MFG. & ENG. CORP.
Lippmann Engineering Works, Inc.
NORDBERG MFG. CO.
Pennsylvania Crusher Div. Bath Iron Works Corp.
Smith Engineering Works
STRAUB MFG. CO.

182 CRUSHERS, DISK

KENNEDY-VAN SAUN MFG. & ENG. CORP.
NORDBERG MFG. CO.
STURTEVANT MILL CO.

183 CRUSHERS, GYRATORY

Acme Road Machinery Co., Inc.
ALLIS-CHALMERS MFG. CO.
KENNEDY-VAN SAUN MFG. & ENG. CORP.
MACHINERY CENTER, INC.
MINE & SMELTER SUPPLY CO. MARCY MILL DIV.
NORDBERG MFG. CO.
Pennsylvania Crusher Div. Bath Iron Works Corp.
Smith Engineering Works
STRAUB MFG. CO.
TRAYLOR ENGINEERING & MFG. CO.

184 CRUSHERS, HAMMER

Acme Road Machinery Co., Inc.
ALLIS-CHALMERS MFG. CO.
American Pulverizer Co.
Bartlett & Snow Co., C. O.
Buffalo Hammer Mill Corp.
Diamond Iron Works Div. Goodman Mfg. Co.
DIESEL ENERGY CORP.
Gruendler Crusher & Pulverizer Co.
Hammermills, Inc.
IOWA MFG. CO.
JEFFREY MFG. CO.
KENNEDY-VAN SAUN MFG. & ENG. CORP.
Kensington Steel Co.
Lippmann Engineering Works, Inc.
Metal Carbides Corp.
Metals Disintegrating Co. Inc. Pulverizing Machinery Div.
Pennsylvania Crusher Div. Bath Iron Works Corp.
Pettibone Mulliken Corp.
Pioneer Engineering, Div. Poor & Co.
Pulva Corp.
Rogers Iron Works Co.
Specialty Engineering Co.
STURTEVANT MILL CO.
Universal Engineering Corp.
Williams Patent Crusher & Pulverizer Co.

185 CRUSHERS, IMPACT

ALLIS-CHALMERS MFG. CO.
American Pulverizer Co.
Bartlett & Snow Co., C. O.
Fahrenwald Co., A. W.
Gruendler Crusher & Pulverizer Co.
Hazemag USA Inc.
IOWA MFG. CO.
JEFFREY MFG. CO.
KENNEDY-VAN SAUN MFG. & ENG. CORP.
Hammermills, Inc.
Holmes & Bros., Inc. Robert
JOY MFG. CO.
Lippmann Engineering Works, Inc.
Mead Mill Co.
NORDBERG MFG. CO.
Pennsylvania Crusher Div. Bath Iron Works Corp.
Pettibone Mulliken Corp.
Pioneer Engineering Div. Poor & Co., Inc.
Pulva Corp.
Pulverizing Machinery Div., Metals Disintegration Co., Inc.
Rogers Iron Works Co.
Specialty Engineering Co.
Stephens-Adamson Mfg. Co.
STURTEVANT MILL CO.
Universal Engineering Corp.
Williams Patent Crusher & Pulverizer Co.

186 CRUSHERS, JAW

Acme Road Machinery Co., Inc.
ALLIS-CHALMERS MFG. CO.
Alloy Steel & Metals Co.
Bacon-Greene & Milroy
BALDWIN - LIMA - HAMILTON CORP. CONSTRUCTION EQUIPMENT DIV.
Bico, Inc.
BIRDSBORO STEEL FOUNDRY & MACHINE CO.
Denver Equipment Co.
Denver Fire Clay Co.
Diamond Iron Works Div. Goodman Mfg. Co.
DIESEL ENERGY CORP.
Fahrenwald Co., A. W.
Farrel-Birmingham Co., Inc.
Gruendler Crusher & Pulverizer Co.
Hammermills, Inc.
IOWA MFG. CO.
JEFFREY MFG. CO.
KENNEDY-VAN SAUN MFG. & ENG. CORP.
Lippmann Engineering Works, Inc.
McLANAHAN & STONE CORP.
MINE & SMELTER SUPPLY CO., MFG. DIV.
Mofse Bros. Machinery Co.
Pennsylvania Crusher Div. Bath Iron Works Corp.
Pettibone Mulliken Corp.
Pioneer Engineering Div. Poor & Co., Inc.
Rogers Iron Works Co.
Smith Engineering Works
STRAUB MFG. CO.
Stroh Process Steel Co.
STURTEVANT MILL CO.
TRAYLOR ENGINEERING & MFG. CO.
Universal Engineering Corp.
Universal Road Machinery Co.

187 CRUSHERS, MOBILE UNITS

Acme Road Machinery Co., Inc.
BALDWIN - LIMA - HAMILTON CORP. CONSTRUCTION EQUIPMENT DIV.
Bonded Scale & Machine Co.
Denver Equipment Co.
Diamond Iron Works Div. Goodman Mfg. Co.
Gruendler Crusher & Pulverizer Co.
Gundlach Machine Co., T. J. Div. of JMJ Industries, Inc.
Hack Engineering Co.
Hammermills, Inc.
Hazemag
IOWA MFG. CO.
KENNEDY-VAN SAUN MFG. & ENG. CORP.
Lippmann Engineering Works, Inc.
NORDBERG MFG. CO.
Pettibone Mulliken Corp.
Pioneer Engineering Div. Poor & Co., Inc.
Pulverizing Machinery Div., Metals Disintegrating Co., Inc.
Rogers Iron Works Co.
Smith Engineering Works
STRAUB MFG. CO.
Universal Dredge Mfg. Co.
Universal Engineering Corp.
Universal Road Machinery Co.

188 CRUSHERS, RING ROLL

Abbé Engineering Co.
American Pulverizer Co.
Gruendler Crusher & Pulverizer Co.
JEFFREY MFG. CO.
Pennsylvania Crusher Div. Bath Iron Works Corp.
Stephens-Adamson Mfg. Co.
STURTEVANT MILL CO.
Williams Patent Crusher & Pulverizer Co.

189 CRUSHERS, ROLL

Abbé Engineering Co.
Acme Road Machinery Co., Inc.
ALLEN-SHERMAN-HOFF CO.
ALLIS-CHALMERS MFG. CO.
BALDWIN - LIMA - HAMILTON CORP. CONSTRUCTION EQUIPMENT DIV.
Bartlett & Snow Co., C. O.
Bonded Scale & Machine Co.
Denver Equipment Co.
Diamond Iron Works Div. Goodman Mfg Co.
Gruendler Crusher & Pulverizer Co.
Gundlach Machine Co., T. J. Div. of JMJ Industries, Inc.
Hammermills, Inc.
HEWITT-ROBINS, INC.
Hyster Co.
IOWA MFG. CO.
JEFFREY MFG. CO.
KENNEDY-VAN SAUN MFG. & ENG. CORP.
LINK-BELT CO.
Lippmann Engineering Works, Inc.
McLANAHAN & STONE CORP.
McNALLY PITTSBURG MFG. CORP.
Metal Carbides Corp.
Metals Disintegrating Co., Inc. Pulverizing Machinery Div.
MINE & SMELTER SUPPLY CO., MFG. DIV
Pennsylvania Crusher Div. Bath Iron Works Corp.
Pettibone Mulliken Corp.
Pioneer Engineering Div. Poor & Co., Inc.
Ridge Equipment Co.
Rogers Iron Works Co.
Smith Engineering Works
Stephens-Adamson Mfg. Co.
STURTEVANT MILL CO.
TRAYLOR ENGINEERING & MFG. CO.
Universal Engineering Corp.
Williams Patent Crusher & Pulverizer Co.

190 CRUSHER PARTS

Abbé Engineering Co.
Acme Road Machinery Co., Inc.
Alco Products, Inc.
ALLIS-CHALMERS MFG. CO.
Alloy Steel & Metals Co.
AMERICAN BRAKE SHOE CO. AMERICAN MANGANESE STEEL DIV.
American Forge Co.
American Pulverizer Co.
BABCOCK & WILCOX CO.
Bacon-Greene & Milroy
BALDWIN-LIMA-HAMILTON CORP. CONSTRUCTION EQUIPMENT DIV.
BALDWIN-LIMA-HAMILTON CORP. STANDARD STEEL WORKS DIV.
Bico, Inc.
Bonded Scale & Machine Co.
Columbia Steel Casting Co., Inc.
Electric Steel Foundry Co.
Frog, Switch & Mfg. Co.
Gatke Corp.
Hammermills, Inc.
Hirsch Bros. Machy. Co.
Industrial Overlay Metals, Inc.
IOWA MFG. CO.
JEFFREY MFG. CO.
KENNEDY-VAN SAUN MFG. & ENG. CORP.
Kensington Steel Div., Poor & Co.
Ladish Co.
Lippmann Engineering Works, Inc.
Metal Carbides Corp.
NATIONAL MALLEABLE & STEEL CASTINGS CO.
Pennsylvania Crusher Div. Bath Iron Works Corp.
Pettibone Mulliken Corp.
Pioneer Engineering Div. Poor & Co., Inc.
Rogers Iron Works Co.
Sorel Steel Foundries, Ltd.
Specialty Engineering Co.
Stroh Process Steel Co.
Thomas Foundries Inc.
Tool Steel Gear & Pinion Co.
TRAYLOR ENGINEERING & MFG. CO.
Universal Engineering Corp.
Western Gear Corp.
Williams Patent Crusher & Pulverizer Co.

191 CUTTING MACHINES (ROCK)—does not include Continuous Miners & Planners

American Instrument Co., Inc.
Clipper Mfg. Co.
Drilling Accessory & Mfg. Co., Inc.
Goodman Mfg. Co.
Hales Co., W. M.
Herold Mfg. Co.
JOY MFG. CO.
MOBILE DRILLING, INC.
Salem Tool Co.
Westinghouse Air Brake Co.

192 CUTTING MACHINE BITS (ROCK)

Airdox Cardox Products Co.
Allegheny Ludlum Steel Corp.
Cincinnati Mine Mach'y Co.
CRUCIBLE STEEL CO. OF AMERICA
Firth Sterling, Inc.
Gibraltar Equipment & Mfg. Co.
Hales Co., WM. M.
Herold Mfg. Co.
Hoffman Bros. Drilling Co.
Kennametal Inc. Mining Tool Div.
Marathon Coal Bit Co. Inc.
Metallurgical Products Dept. General Electric Co.
MOBILE DRILLING, INC.
Pickard Industries, Inc. Central Mine Supply Co., Div.
Salem Tool Co.
Vascoloy-Ramet Corp.
Westinghouse Air Brake Co.

193 CUTTING MACHINE PARTS (ROCK)

Cincinnati Mine Mach'y Co.
Flood City Brass & Elec. Co.
JOY MFG. CO.
Mining Machine Parts, Inc.
MOBILE DRILLING, INC.
Penn Machine Co.
Salem Tool Co.
Simonds Worden White Co.
Westinghouse Air Brake Co.

(CYANIDE)—see Chemicals

194 CYANIDING PROCESS EQUIPMENT (SPECIAL)—does not include standard auxiliary equipment

Denver Equipment Co.
Graver Water Conditioning Co.
MACHINERY CENTER, INC.
National Tank & Pipe Co.

195 CYLINDERS, AIR & HYDRAULIC

Anthony Co.
Bailey Meter Co.
Benton Harbor Engineering Works, Inc.
B-I-F Industries, Inc.

CARD IRON WORKS, C. S.
Commercial Shearing & Stamping Co.
Curtis Manufacturing Co.
Erie Strayer Co.
Galland Henning Mfg. Co. Nopak Div.
Kidde & Co., Inc., Walter
Ledeen, Inc.
MINNEAPOLIS-HONEYWELL REGULATOR CO. INDUSTRIAL DIV.
Moran Engineering Co.
Oilgear Co.
Owatonna Tool Co.
Star Jack Co.
Telluride Iron Works Co.
Vickers Inc.
Anker-Holth Div., Wellman Engineering Co.
Westinghouse Air Brake Co. Ind. Products Div.

D

196 DIAMONDS, INDUSTRIAL

ACKER DRILL CO.
American Coldset Corp.
CHRISTENSEN DIAMOND PRODUCTS CO.
Diamond Drill Carbon Co.
Diamond Products, Inc.
DIAMOND TOOL RESEARCH CO., INC.
Drilling Accessory & Mfg. Co., Inc.
Hoffman Bros. Drilling Co.
Koebel Diamond Tool Co.
Metal Carbides Corp.
METALLURGICAL PRODUCTS DEPT., GENERAL ELECTRIC CO.
SMIT & CO., ANTON
SMIT & SONS, INC., J. K.
SPRAGUE & HENWOOD, INC.
Varel Mfg. Co.
Wiley's Carbide Tool Co.

197 DIAMOND CONCENTRATING EQUIPMENT (SPECIAL)—does not include standard auxiliary equipment

Denver Equipment Co.
Hoffman Bros. Drilling Co.

(DOORS, MINE—see Mine Doors)

198 DRAFTING EQUIPMENT & SUPPLIES — also see Blue Photo & White Print Machines

Berger & Sons, C. L., Inc.
Black Diamond Spad Co.
Bruning Co., Inc. Charles
Dixon Crucible Co., Joseph
Geo-Optic & Paper Corp.
Gerber Scientific Instrument Co.
Kern Instruments, Inc.
Keuffel & Esser Co.
Lafayette Radio Corp.
Ozalid Div., General Aniline & Film Corp.
Pease Co. C. F.
Post Co., Frederick
Suverkrop Instruments
Warren-Knight Co.

(DRAGLINES — see Excavators)

199 DREDGES, BUCKETLINE

DRAVO CORP.
ELLICOTT MACHINE CORP.
Washington Iron Works
YUBA CONSOLIDATED INDUSTRIES, INC., YUBA MINING DIV.

200 DREDGES, DIPPER SHOVEL

DRAVO CORP.
ELLICOTT MACHINE CORP.
MANITOWOC ENGINEERING CORP.
Sorel Steel Foundries, Ltd.

201 DREDGES, DRAGLINE & GRAB CRANE

AMERICAN HOIST & DERRICK CO.
Bodinson Manufacturing Co., Inc.
DRAVO CORP.
ELLICOTT MACHINE CORP.
Hyster Co.
MANITOWOC ENGINEERING CORP.
Meckum Engineering

202 DREDGES SUCTION

AMERICAN BRAKE SHOE CO. AMERICAN MANGANESE STEEL DIV.
AMERICAN HOIST & DERRICK CO.
Eagle Iron Works
ELLICOTT MACHINE CORP.
Erie Pump & Engine Works
Essick Manufacturing Co.
Hack Engineering Co.
Meckum Engineering Co.
MORRIS MACHINE WORKS
Pacific Coast Engineering Co.
Universal Dredge Mfg. Co.
YUBA CONSOLIDATED INDUSTRIES, INC., YUBA MINING DIV.

203 DREDGES HULLS—also see Barges

Bodinson Manufacturing Co., Inc.
DRAVO CORP.
ELLICOTT MACHINE CORP.
Meckum Engineering, Inc.
Pacific Coast Engineering Co.
Wiley Mfg. Co.
YUBA CONSOLIDATED INDUSTRIES, INC., YUBA MINING DIV.

204 DREDGE SLEEVES

ELLICOTT MACHINE CORP.
Goodall Rubber Co.
GOODRICH INDUSTRIAL PRODUCTS CO., B. F.
HEWITT-ROBINS, INC.
New York Belting & Packing Co.
PORTER COMPANY, INC., H. K., THERMOID DIV.
RAYBESTOS-MANHATTAN, INC. MANHATTAN RUBBER DIV.
Republic Rubber Div. Lee Rubber & Tire Corp.

205 DRILLS (ROCK & EARTH), AUGER (SURFACE RIG)

ACKER DRILL CO.
Airdox-Cardox Corp. Hardsocg Div.
CHICAGO PNEUMATIC TOOL CO.
Drilling Accessory & Mfg. Co., Inc.
GARDNER-DENVER CO.
Hoffman Bros. Drilling Co.
Holman Bros.—Canada Ltd.
Houston Tool Co., Inc.
INGERSOLL-RAND CO.
JOY MFG. CO.
Leetonia Tool Co.
MACHINERY CENTER, INC.
MAYHEW MACHINE DIV. (GARDNER-DENVER CO.)
Metallurgical Products Dept. General Electric Co.
MOBILE DRILLING, INC.
Pennsylvania Drilling Co.
Pickard Industries, Inc. Central Mine Supply Co., Div.
REICHDRILL DIV., CHICAGO PNEUMATIC TOOL CO.
Salem Tool Co.
Schroeder Brothers Corp.
Stardrill-Keystone Co., Div. Koehring Co.
Thor Power Tool Co.
Worthington Corp.

206 DRILLS (ROCK), CHURN

BUCYRUS-ERIE CO.
GARDNER-DENVER CO.
Hoffman Bros. Drilling Co.
Hossfeld Mfg. Co.
MOBILE DRILLING, INC.
National Welding & Mfg. Co.
Sanderson Cyclone Drill Co.
Spang & Co.
Stardrill-Keystone Co., Div. Koehring Co.

207 DRILLS (ROCK), DIAMOND

ACKER DRILL CO.
BOYLES BROS. DRILLING CO., LTD. (VANCOUVER)
BUCYRUS-ERIE CO.
CHICAGO PNEUMATIC TOOL CO.
Diamond Drill Carbon Co.
DIAMOND DRILL CONTRACTING CO.
Diamond Products, Inc.
DIAMOND TOOL RESEARCH CO., INC.
Drilling Accessory & Mfg. Co., Inc.
Failing Co., George E.
Havlick, J. L.
Hoffman Bros. Drilling Co.
JOY MFG. CO.
Junction Bit & Tool Co.
Koebel Diamond Tool Co.
Longyear Co., E. J.
MAYHEW MACHINE DIV. (GARDNER-DENVER CO.)
McClintock Co., R. S.
Metal Carbides Corp.
MOBILE DRILLING, INC.
Mott Core Drilling Co.
Packsack Diamond Drills, Ltd.
Pennsylvania Drilling Co.
REICHDRILL DIV., CHICAGO PNEUMATIC TOOL CO.
SPRAGUE & HENWOOD, INC.
Stardrill-Keystone Co., Div. Koehring Co.
WHEEL TRUEING TOOL CO.

208 DRILLS (ROCK), FLAME-JET PIERCING

BUCYRUS-ERIE CO.
Linde Co. Union Carbide Corp.

209 DRILLS (ROCK & EARTH), WATER-JET—does not include Monitors

Carpco Manufacturing, Inc.

210 DRILLS (ROCK), PERCUSSION, LARGE HOLE (+4-IN.), QUARRY & WELL

Acme Machinery Co.
Airdox-Cardox Corp., Hardsocg Div.
BUCYRUS-ERIE CO.
Failing Co., George E.
GARDNER-DENVER CO.
Hoffman Bros. Drilling Co.
INGERSOLL-RAND CO.
JOY MFG. CO.
Junction Bit & Tool Co.
MAYHEW MACHINE DIV. (GARDNER-DENVER CO.)
Metal Carbides Corp.
MOBILE DRILLING, INC.
REICHDRILL DIV., CHICAGO PNEUMATIC TOOL CO.
Sanderson Cyclone Drill Co.
Stardrill-Keystone Co., Div. Koehring Co.
LE ROI DIV. WESTINGHOUSE AIR BRAKE CO.
Worthington Corp.

211 DRILLS (ROCK), PERCUSSION, LARGE HOLE (+4-IN.), QUARRY & WELL, "DOWN-THE-HOLE" TYPE ONLY

GARDNER-DENVER CO.
INGERSOLL-RAND CO.
JOY MFG. CO.
Junction Bit & Tool Co.
MOBILE DRILLING, INC.
REICHDRILL DIV., CHICAGO PNEUMATIC TOOL CO.
Winter Weiss Co.

212 DRILLS (ROCK), PERCUSSION, SMALL HOLE (—4-IN.)

Acme Machinery Co.
ATLAS COPCO EASTERN, INC.
ATLAS COPCO PACIFIC, INC.
BUCYRUS-ERIE CO.
CHICAGO PNEUMATIC TOOL CO.
GARDNER-DENVER CO.
Hoffman Bros. Drilling Co.
Holman Bros.—Canada Ltd.
Hossfeld Mfg. Co.
INGERSOLL-RAND CO.
Junction Bit & Tool Co.
JOY MFG. CO.
LE ROI DIV. WESTINGHOUSE AIR BRAKE CO.
Metal Carbides Corp.
MOBILE DRILLING, INC.
REICHDRILL DIV., CHICAGO PNEUMATIC TOOL CO.
Salem Tool Co.
Sanderson Cyclone Drill Co.
Schramm, Inc.
Stardrill-Keystone Co., Div. Koehring Co.
Thor Power Tool Co.
Westinghouse Air Brake Co.
Worthington Corp.

213 DRILLS (ROCK), ROTARY LARGE HOLE (+4-IN.), QUARRY & WELL

ACKER DRILL CO.
BOYLES BROS. DRILLING CO., LTD. (VANCOUVER)
BUCYRUS-ERIE CO.
CHICAGO PNEUMATIC TOOL CO.
Davey Compressor Co.
Drilling Accessory & Mfg. Co., Inc.
Failing Co., George E.
GARDNER-DENVER CO.
Hoffman Bros. Drilling Co.
Industrial Overlay Metals, Inc.
INGERSOLL-RAND CO.
Junction Bit & Tool Co.
JOY MFG. CO.
Maschinenfabrik Rudolf Hausherr & Soehne, GmbH c/o B. J. Nykerk Corp.
MAYHEW MACHINE DIV. (GARDNER-DENVER CO.)
Metal Carbides Corp.
MOBILE DRILLING, INC.
REICHDRILL DIV., CHICAGO PNEUMATIC TOOL CO.
Robbins Machine & Manufacturing Co., Inc.
Salem Tool Co.
Schramm, Inc.
Stardrill-Keystone Co., Div. Koehring Co.
Westinghouse Air Brake Co.
Winter Weiss Co.
Worthington Corp.

214 DRILLS (ROCK), ROTARY, SMALL HOLE (—4-IN.)

ACKER DRILL CO.
Allegheny Ludlum Steel Corp.
BOYLES BROS. DRILLING CO., LTD. (VANCOUVER)
BUCYRUS-ERIE CO.
CHICAGO PNEUMATIC TOOL CO.
Davey Compressor Co.
DIAMOND DRILL CONTRACTING CO.
Diamond Products, Inc.
Drilling Accessory & Mfg. Co., Inc.
Fletcher & Co., J. H.
GARDNER-DENVER CO.
Hoffman Bros. Drilling Co.
Houston Tool Co., Inc.
Industrial Overlay Metals, Inc.
INGERSOLL-RAND CO.
JOY MFG. CO.
Long Co.
Maschinenfabrik Rudolf Hausherr & Soehne GmbH c/o B. J. Nykerk Corp.
MAYHEW MACHINE DIV. (GARDNER-DENVER CO.)
Metal Carbides Corp.
MOBILE DRILLING, INC.
Pennsylvania Drilling Co.
REICHDRILL DIV., CHICAGO PNEUMATIC TOOL CO.
Salem Tool Co.
Schramm, Inc.
Seiscor Manufacturing Co.
Seismograph Service Corp.
Star Expansion
Stardrill-Keystone Co., Div. Koehring Co.
Westinghouse Air Brake Co.
Winter Weiss Co.
Worthington Corp.

215 DRILLS (ROCK), ROTARY PERCUSSION, SMALL HOLE (—4-IN.)

JOY MFG. CO.
Junction Bit & Tool Co.
Maschinenfabrik Rudolf Hausherr & Soehne, GmbH c/o B. J. Nykerk Corp.
MOBILE DRILLING, INC.
Reich Bros. Mfg. Co.
Salem Tool Co.

216 DRILLS (ROCK), SELF-CONTAINED POWER, PACK-PORTABLE PERCUSSION

ATLAS COPCO PACIFIC, INC.
Hossfeld Mfg. Co.
Lovequist Engrg. Co.
Pitnam Industrial Products Co.
Stanco Mfg. & Sales Co.
Syntron Co.
Warsop Power Tools Ltd.

217 DRILLS (ROCK), SELF-CONTAINED POWER, PACK-PORTABLE, ROTARY (& CORE)

ACKER DRILL CO.
BOYLES BROS. DRILLING CO., LTD.
DIAMOND DRILL CONTRACTING CO.
Demo Tool Corp.
Havlick, J. L.
Homelite Div., Textron Inc.
Houston Tool Co., Inc.
Packsack Diamond Drills, Ltd.

218 DRILLS, BORERS & CORERS SPECIAL LARGE DIAMETER RIGS (+12

in.)—also see Continuous Miners; does not include Cutting Machines or other drills listed above

Airdox Cardox Products Co.
REICH DRILL DIV., CHICAGO PNEUMATIC TOOL CO.

219 DRILL (ROCK) BITS, AUGER

ACKER DRILL CO.
Airdox-Cardox Corp. Hardscog Div.
Central Mine Equipment Co.
CHICAGO PNEUMATIC TOOL CO.
Diamond Drill Contracting Co.
Failing Co., George E.
GARDNER-DENVER CO.
Hawthorne, Inc., Herb J.
Hoffman Bros. Drilling Co.
Houston Tool Co., Inc
INGERSOLL-RAND CO.
Kennametal Inc. Mining Tool Div.
MAYHEW MACHINE DIV. (GARDNER-DENVER CO.)
Metal Carbides Corp.
Metallurgical Products Dept. General Electric Co.
MOBILE DRILLING, INC.
NATIONAL MINE SERVICE CO.
Pennsylvania Drilling Co
REICH DRILL DIV., CHICAGO PNEUMATIC TOOL CO.
Salem Tool Co.
Schroeder Brothers Corp.
Stardrill-Keystone Co., Div. Koehring Co.
Vascoloy-Ramet Corp.
Worthington Corp.

220 DRILL (ROCK) BITS (& STEMS), CHURN

BUCYRUS-ERIE CO.
MOBILE DRILLING, INC.
Sanderson Cyclone Drill Co.
Stardrill-Keystone Co., Div. Koehring
Spang & Co.
Worthington Corp.

221 DRILL (ROCK) BITS, CORE

ACKER DRILL CO.
American Coldset Corp.
BOYLES BROS. DRILLING CO., LTD. (VANCOUVER)
CHRISTENSEN DIAMOND PRODUCTS CO.
Davey Compressor Co.
Diamond Drill Carbon Co.
DIAMOND DRILL CONTRACTING CO.
Drilling Accessory & Mfg. Co., Inc.
Diamond Products, Inc.
Failing Co., George E.
GARDNER-DENVER CO.
Hoffman Bros. Drilling Co.
Houston Tool Co., Inc.
JOY MFG. CO.
Kennametal Inc. Mining Tool Div.
Longyear Co., E. J.
MAYHEW MACHINE DIV. (GARDNER-DENVER CO.)
McClintock Co., R. S.
Metal Carbides Corp.
Milwaukee Electric Tool Corp.
MOBILE DRILLING, INC.
Mott Core Drilling Co.
Pennsylvania Drilling Co.
Reed Roller Bit Co.
Salem Tool Co.
SPRAGUE & HENWOOD, INC.
Star Expansion
Stardrill-Keystone Co., Div. Koehring Co.
Varel Mfg. Co.
Westinghouse Air Brake Co.
Worthington Corp.

222 DRILL (ROCK) BITS, DIAMOND

ACKER DRILL CO.
American Coldset Corp.
BOYLES BROS. DRILLING CO., LTD. (VANCOUVER)
CHRISTENSEN DIAMOND PRODUCTS CO.
Davey Compressor Co.
Diamond Drill Carbon Co.
DIAMOND DRILL CONTRACTING CO.
Diamond Products, Inc.
DIAMOND TOOL RESEARCH CO., INC.
Drilling Accessory & Mfg. Co., Inc.
Failing Co., George E.
Havlick, J. L.
Hoffman Bros. Drilling Co.
JOY MFG. CO.
Koebel Diamond Tool Co
Longyear Co., E. J.
MAYHEW MACHINE DIV. (GARDNER-DENVER CO.)
McClintock Co., R. S.
Metal Carbides Corp.
Milwaukee Electric Tool Corp.
MOBILE DRILLING, INC.
Mott Core Drilling Co.
Packsack Diamond Drills, Ltd.
Pennsylvania Drilling Co.
Salem Tool Co.
SMIT & CO., ANTON
SMIT & SONS, INC., J. K.
SPRAGUE & HENWOOD, INC.
Stardrill-Keystone Co., Div. Koehring Co.
Varel Mfg. Co.
WHEEL TRUEING CO.

223 DRILL (ROCK) BITS, DIAMOND, RESETTING SERVICE

ACKER DRILL CO.
American Coldset Corp.
BOYLES BROS. DRILLING CO., LTD. (VANCOUVER)
CHRISTENSEN DIAMOND PRODUCTS CO.
Diamond Drill Carbon Co.
DIAMOND DRILL CONTRACTING CO.
Diamond Products, Inc.
DIAMOND TOOL RESEARCH CO., INC.
Drilling Accessory & Mfg. Co., Inc.
Havlick, J. L.
Hoffman Bros. Drilling Co.
JOY MFG. CO.
Koebel Diamond Tool Co.
Longyear Co., E. J.
MAYHEW MACHINE DIV. (GARDNER-DENVER CO.)
McClintock Co., R. S.
Metal Carbides Corp.
Pennsylvania Drilling Co.
SPRAGUE & HENWOOD, INC.
Varel Mfg. Co.
WHEEL TRUEING CO.

224 DRILL (ROCK) BITS, PERCUSSION

Acme Machinery Co.
Airdox-Cardox Products Co.
ATLAS COPCO EASTERN, INC.
ATLAS COPCO PACIFIC, INC.
BRUNNER & LAY, INC.
BUCYRUS-ERIE CO.
Failing Co., George E.
Firth Sterling Inc.
GARDNER-DENVER CO.
Hayes Steel Products, Ltd.
Holman Bros.—Canada Ltd.
INGERSOLL-RAND CO.
JOY MFG. CO.
Kennametal Inc. Mining Tool Div.
Hoyland Steel Co., Inc.
LE ROI DIV. WESTINGHOUSE AIR BRAKE CO.
MAYHEW MACHINE & SUPPLY CO.
Metal Carbides Corp.
Minerals Engineering Co.
MOBILE DRILLING, INC.
Sanderson, Cyclon Drill Co.
Spang & Co.
Star Expansion
Stardrill-Keystone Co., Div. Koehring Co.
Thor Power Tool Co.
Throwaway Bit Corp.
TIMKEN ROLLER BEARING CO.
Vascoloy-Ramet Corp.
WESTERN ROCK BIT MFG. CO.
Westinghouse Air Brake Co.

225 DRILL (ROCK) BITS, ROTARY, ROLLER CONE

ACKER DRILL CO.
Central Mine Equipment Co.
CHICAGO PNEUMATIC TOOL CO.
Davey Compressor Co.
Drilling Accessory & Mfg. Co., Inc.
Failing Co., George E.
Hawthorn, Inc., Herb J.
H. C. Smith Oil Tool Co.
Hoffman Bros. Drilling Co.
Hughes Tool Co.
Industrial Overlay Metals, Inc.
Longyear Co., E. J.
MAYHEW MACHINE & SUPPLY CO.
MOBILE DRILLING, INC.
Pennsylvania Drilling Co.
Reed Roller Bit Co.
SPRAGUE & HENWOOD, INC.
Star Expansion
Stardrill-Keystone Co., Div. Koehring Co.
Varel Mfg. Co.
Westinghouse Air Brake Co.

226 DRILL (ROCK) BITS, ROTARY DRAG; LARGE HOLE (+4-IN.), QUARRY & WELL (SPADE, PRONG, ETC.)

ACKER DRILL CO.
Airdox-Cardox Corp. Hardscog Div.
Central Mine Equipment Co.
Davey Compresssor Co.
Failing Co., George E.
GARDNER-DENVER CO.
Hawthorne, Inc., Herb J.
H. C. Smith Oil Tool Co.
Hoffman Bros. Drilling Co.
Industrial Overlay Metals, Inc.
Kennametal Inc. Mining Tool Div.
Maschinenfabrik Rudolf Hausherr & Soehne, GmbH c/o B. J. Nykerk Corp.
MAHYEW MACHINE DIV. (GARDNER-DENVER CO.)
MINE & SMELTER SUPPLY CO.
MOBILE DRILLING, INC.
Reed Roller Bit Co.
Salem Tool Co.
Stardrill-Keystone Co., Div. Koehring Co.
Varel Mfg. Co.
Westinghouse Air Brake Co.

227 DRILL (ROCK) BITS, ROTARY, DRAG, SMALL HOLE (+4-IN.) (SPADE, PRONG, ETC.)

ACKER DRILL CO.
Airdox-Cardox Products Co.
Allegheny Ludlum Steel Corp.
Central Mine Equipment Co.
Davey Compressor Co.
Drilling Accessory & Mfg. Co., Inc.
Failing Co., George E.
Firth Sterling Inc.
GARDNER-DENVER CO.
Hawthorne, Inc., Herb J.
Hoffman Bros. Drilling Co.
Houston Tool Co., Inc.
Industrial Overlay Metals, Inc.
Kennametal Inc. Mining Tool Div.
Maschinenfabrik Rudolf Hausherr Soehne, GmbH c/o B. J. Nykerk Corp.
MAYHEW MACHINE DIV. (GARDNER-DENVER CO.)
MOBILE DRILLING, INC.
Pennsylvania Drilling Co.
Reed Roller Bit Co.
Stardrill-Keystone Co., Div. Koehring Co.
Thor Power Tool Co.
Varel Mfg. Co.
Vascoloy-Ramet Corp.
Westinghouse Air Brake Co.

228 DRILL (ROCK) BIT & STEEL FORGING & HEAT TREATING FURNACES

Acme Machinery Co.
BUCYRUS-ERIE CO.
GARDNER-DENVER CO.
Hoffman Bros. Drilling Co.
INGERSOLL-RAND CO.
Sanderson Cyclone Drill Co.
Stardrill-Keystone Co., Div. Koehring Co.

229 DRILL (ROCK) BIT & STEEL FORGINGS HAMMERS

GARDNER-DENVER CO.
INGERSOLL-RAND CO.

230 DRILL (ROCK) BIT & STEEL GRINDERS

ATLAS COPCO EASTERN, INC.
ATLAS COPCO PACIFIC, INC.
Bitco, Inc.
Blount Co., J. G.
BRUNNER & LAY INC.
Coeur d'Alene Hardware & Foundry Co.
GARDNER-DENVER CO.
Herold Mfg. Co.
Holman Bros.—Canada Ltd.
INGERSOLL-RAND CO.
JOY MFG. CO.
MINE & SMELTER SUPPLY CO., MFG. DIV.
Standard Electrical Tool Co.
WESTERN ROCK BIT MFG. CO.

231 DRILL (ROCK) BIT & STEEL LATHES

INGERSOLL-RAND CO.

232 DRILL (ROCK) BOOMS, EXTENSIBLE & MOTILE—also see: Booms & Towers; Drill (Rock) Jumbos

CHICAGO PNEUMATIC TOOL CO.
Fletcher & Co., J. H.
INGERSOLL-RAND CO.
JOY MFG. CO.
LE ROI DIV. WESTINGHOUSE AIR BRAKE CO.
Markley Dust Control System, Inc.
REICHDRILL DIV., CHICAGO PNEUMATIC TOOL CO.
Rogers Iron Works Co.
Spencer Turbine Co.
Thor Power Tool Co.
Westinghouse Air Brake Co.

233 DRILL (ROCK) CORE BARRELS

ACKER DRILL CO.
American Coldset Corp.
BOYLES BROS. DRILLING CO., LTD. (VANCOUVER)
CHRISTENSEN DIAMOND PRODUCTS CO.
Davey Compressor Co.
DIAMOND DRILL CONTRACTING CO.
Drilling Accessory & Mfg. Co., Inc.
Failing Co., George E.
GARDNER-DENVER CO.
Hoffman Bros. Drilling Co.
JOY MFG. CO.
Longyear Co., E. J.
MAYHEW MACHINE DIV. (GARDNER-DENVER CO.)
Milwaukee Electric Tool Corp.
Minerals Engineering Co.
MOBILE DRILLING INC.
Mott Core & Drilling Co.
Pennsylvania Drilling Co.
Reed Roller Bit Co.
SPRAGUE & HENWOOD, INC.
Stardrill-Keystone Co., Div. Koehring Co.

234 DRILL (ROCK) DUST COLLECTORS (SMALL HOLE DRILLS)

Acme Machinery Co.
Davey Compressor Co.
Drilling Accessory & Mfg. Co., Inc.
DUCON INC.
Failing Co., George E.
GARDNER-DENVER CO.
Hayes Steel Products, Ltd.
Holman Bros.—Canada Ltd.
MOBILE DRILLING, INC.
Schroeder Brothers Corp.

235 DRILL (ROCK) DUST COLLECTORS (QUARRY DRILLS)

Davey Compressor Co.
DUCON, INC.
Failing Co., George E.
GARDNER-DENVER CO.
INGERSOLL-RAND CO.
Markley Dust Control System, Inc.
MAYHEW MACHINE DIV. (GARDNER-DENVER CO.)
Spencer Turbine Co.

236 DRILL (ROCK) JUMBOS & WAGONS—also see: Booms & Towers; Drill (Rock) Booms

Acme Machinery Co.
CHICAGO PNEUMATIC TOOL CO.
Coeur d'Alene Hardware & Foundry Co.
GARDNER-DENVER CO.
Hayes Steel Products, Ltd.
INGERSOLL-RAND CO.
JOY MFG. CO.
LE ROI DIV. WESTINGHOUSE AIR BRAKE CO.
MACHINERY CENTER, INC.
Maschinenfabrik Rudolf Hausherr & Soehne GmbH c/o B. J. Nykerk
MAYO TUNNEL & MINE EQUIPMENT
Minerals Engineering Co.
REICH DRILL DIV., CHICAGO PNEUMATIC TOOL CO.
Rogers Iron Works Co.
Sanford-Day Iron Works, Inc.
Schramm, Inc.
Thor Power Tool Co.
Westinghouse Air Brake Co.
Winter Weiss Co.
Worthington Corp.

237 DRILL (ROCK) RODS, DIAMOND

ACKER DRILL CO.
Bethlehem Pacific Coast Steel Corp.
BOYLES BROS. DRILLING CO., LTD. (VANCOUVER)
BRUNNER & LAY INC.
CHRISTENSEN DIAMOND PRODUCTS CO.
CRUCIBLE STEEL CO. OF AMERICA
Diamond Drill Carbon Co.
DIAMOND DRILL CONTRACTING CO.

Drilling Accessory & Mfg. Co., Inc.
Failing Co., George E.
Hoffman Bros. Drilling Co.
Hoyland Steel Co., Inc.
JOY MFG. CO.
Koebel Diamond Tool Co.
Longyear Co., E. J.
MAYHEW MACHINE DIV. (GARDNER-DENVER CO.)
Minerals Engineering Co.
MOBILE DRILLING, INC.
Mott Core Drilling Co.
Pennsylvania Drilling Co.
SPRAGUE & HENWOOD, INC.

238 DRILL (ROCK) RODS, PERCUSSION

Acme Machinery Co.
ATLAS COPCO EASTERN, INC.
ATLAS COPCO PACIFIC, INC.
Atlas Steels, Ltd.
Bethlehem Pacific Coast Steel Corp.
BETHLEHEM STEEL CO.
Bitco, Inc.
Black's Machine Shop
BRUNNER & LAY INC.
Coeur d'Alene Hardware & Foundry Co.
CRUCIBLE STEEL CO. OF AMERICA
GARDNER-DENVER CO.
Hoyland Steel Co., Inc.
INGERSOLL-RAND CO.
JOY MFG. CO.
Marathon Coal Bit Co. Inc.
Minerals Engineering Co.
MOBILE DRILLING, INC.
Sanderson Cyclone Drill Co.
Stardrill-Keystone Co., Div. Koehring Co.
Thor Power Tool Co.
Westinghouse Air Brake Co.

239 DRILL (ROCK) RODS, ROTARY LARGE HOLE (QUARRY & WELL)

ACKER DRILL CO.
Atlas Steels, Ltd.
BOYLES BROS. DRILLING CO., LTD. (VANCOUVER)
CRUCIBLE STEEL CO. OF AMERICA
Davey Compressor Co.
Drilling Accessory & Mfg. Co., Inc.
Failing Co., George E.
GARDNER-DENVER CO.
Hoffman Bros. Drilling Co.
Hoyland Steel Co., Inc.
INGERSOLL-RAND CO.
JOY MFG. CO.
Marathon Coal Bit Co. Inc.
Machinenfabrik Rudolf Hausherr & Soehne, GmbH c/o B. J. Nykerk Corp.
MAYHEW MACHINE DIV. (GARDNER-DENVER CO.)
MOBILE DRILLING INC.
REICHDRILL DIV., CHICAGO PNEUMATIC TOOL CO.
Sanderson Cyclone Drill Co.
Schramm, Inc.
Stardrill-Keystone Co., Div. Koehring Co.
Winter Weiss Co.

240 DRILL (ROCK) RODS, ROTARY SMALL HOLE

ACKER DRILL CO.
ATLAS COPCO PACIFIC, INC.
Atlas Steels, Ltd.
Bethlehem Pacific Coast Steel Corp.
BOYLES BROS. DRILLING CO., LTD. (VANCOUVER)
CRUCIBLE STEEL CO. OF AMERICA
Davey Compressor Co.
DIAMOND DRILL CONTRACTING CO.
Drilling Accessory & Mfg. Co., Inc.
GARDNER-DENVER CO.
Guyan Machinery Co.
Hoffman Bros. Drilling Co.
Hoyland Steel Co., Inc.
INGERSOLL-RAND CO.
JOY MFG. CO.
Marathon Coal Bit Co. Inc.
Machinenfabrik Rudolf Hausherr & Soehne, GmbH c/o B. J. Nykerk Corp.
MAYHEW MACHINE DIV. (GARDNER-DENVER CO.)
MOBILE DRILLING, INC.
Pennsylvania Drilling Co.
REICHDRILL DIV., CHICAGO PNEUMATIC TOOL CO.
Sanderson Drill Cyclone Co.
Schramm, Inc.
SPRAGUE & HENWOOD, INC.
Stardrill-Keystone Co., Div. Koehring Co.
Thor Power Tool Co.
Varel Mfg. Co.
Westinghouse Air Brake Co.
Winter Weiss Co.

241 DRILL (ROCK) ROD COUPLINGS

Acme Machinery Co.
ATLAS COPCO EASTERN, INC.
ATLAS COPCO PACIFIC, INC.
Bitco, Inc.
BOYLES BROS. DRILLING CO., LTD. (VANCOUVER)
BRUNNER & LAY INC.
CRUCIBLE STEEL CO. OF AMERICA
DIAMOND DRILL CONTRACTING CO.
Drilling Accessory & Mfg. Co., Inc.
GARDNER-DENVER CO.
INGERSOLL-RAND CO.
JOY MFG. CO.
Maschinenfabrik Rudolf Hausherr & Soehne, GmbH c/o B. J. Nykerk Corp.
Minerals Engineering Co.
MOBILE DRILLING, INC.
REICHDRILL DIV., CHICAGO PNEUMATIC CO.
SPRAGUE & HENWOOD, INC.
Thor Power Tool Co.
Winter Weiss Co.

(DRILL STEEL — see Drill (Rock) Rods)

242 DRILL (ROCK) SUPPORTS (COLUMNS, BARS, ETC.)—also see Drill (Rock) Jumbos; Drill (Rock) Booms

CHICAGO PNEUMATIC TOOL CO.
GARDNER DENVER CO.
Hayes Steel Products, Ltd.
INGERSOLL-RAND CO.
JOY MFG. CO.
LE ROI DIV. WESTINGHOUSE AIR BRAKE CO.
Minerals Engineering Co.
Thor Power Tool Co.
Westinghouse Air Brake Co.

(DRIVES, MECHANICAL POWER TRANSMISSION —see below; also see: Clutches; Couplings, Power Take-Offs; Gear Motors)

243 DRIVES, BELT

ALLIS-CHALMERS MFG. CO.
AMERICAN PULLEY CO.
American Rubber Mfg. Co.
Browning Mfg. Co.
Christian Engineers, J. D.
CONTINENTAL GIN CO. INDUSTRIAL DIV.
DODGE MFG. CORP.
FLEXIBLE STEEL LACING CO.
GATES RUBBER CO.
Graton & Knight Co. Inc.
HEWITT-ROBINS, INC.
Hirsch Bros. Machy. Co.
Houghton & Co., E. F.
Kanawha Mfg. Co.
LINK-BELT CO.
MC NALLY PITTSBURG MFG. CORP.
Morse Chain Co., Div. Borg-Warner Industries
NATIONAL IRON CO.
New York Belting & Packing Co.
PORTER COMPANY, INC., H. K., THERMOID DIV.
RAYBESTOS-MANHATTAN, INC. MANHATTAN RUBBER DIV.
Wood's Sons Co., T. B.
J. S. Rubber Co. Mechanical Goods Div.

244 DRIVES, CHAIN

Bartlett & Snow Co., C. O.
Browning Mfg. Co.
Chain Belt Co.
Christian Engineers, J. D.
CONTINENTAL GIN CO. INDUSTRIAL DIV.
Diamond Chain Co., Inc.
DODGE MFG. CORP.
Hirsch Bros. Machy. Co.
JEFFREY MFG. CO.
LINK-BELT CO.
MC NALLY PITTSBURG MFG. CORP.
Morse Chain Co. A Borg-Warner Industry
NATIONAL IRON CO.
Ohio Gear Co.
Union Chain & Mfg. Co.
Voland & Sons, Inc.
Webb Co., Jervis B.
Whitney Chain Co.

245 DRIVES, FLUID

American-Standard Industrial Div.
Christian Engineers, J. D.
CLARK EQUIPMENT CO. TRANSMISSION DIV.
DODGE MFG. CORP.
Fuller Manufacturing Co.
GENERAL MOTORS CORP. ALLISON DIV.
Imperial Electric Co.
LINK-BELT CO.
Master Electric Co.
Oilgear Co.
Prime Mover Co.
Rockwell Manufacturing Co., Hydraulic Div.
Schroeder Brothers Corp.
Titeflex, Inc.
Twin Disc Clutch Co.
Vickers Inc.
Western Gear Corp.

246 DRIVES, GEAR

Allis Co., Louis
AMERICAN PULLEY CO.
Bartlett & Snow Co., C. O.
Brown, Inc., David
Christian Engineers, J. D.
Cleveland Worm & Gear Co.
Cone-Drive Gears Div. Michigan Tool Co.
CONTINENTAL GIN CO. INDUSTRIAL DIV.
DeLaval Steam Turbine Co.
Eaton Manufacturing Co.
FALK CORP.
Farrel-Birmingham Co., Inc.
Foote Bros. Gear & Machine Corp.
Fuller Manufacturing Co.
GENERAL ELECTRIC CO. GEAR MOTOR & TRANSMISSION COMPONENTS DEPT.
GENERAL MOTORS CORP. ALLISON DIV.
HEWITT-ROBINS, INC.
Hirsch Bros. Machy. Co.
Imperial Electric Co.
Kanawha Mfg. Co.
Lima Electric Motor Co.
LINK-BELT CO.
Master Electric Co.
Mechanical Power Transmission Div., Zurn Industries, Inc.
McNALLY PITTSBURG MFG. CORP.
NATIONAL IRON CO.
Ohio Gear Co.
Perkins Machine & Gear Co.
PHILADELPHIA, GEAR CORP.
Rockwell Spring & Axe Co. Timken-Detroit Axle Div.
Snow-Nabstedt Gear Corp.
Stephens-Adamson Mfg. Co.
Sterling Electric Motors, Inc.
Stimmel Winch Co., Inc.
Stroh Process Steel Co.
Tool Steel Gear & Pinion Co.
Twin Disc Clutch Co.
U. S. Electrical Motors, Inc.
Universal Gear Div., Novo Pump & Engine Co.
Wagner Electric Corp.
Western Gear Corp.
WESTINGHOUSE ELECTRIC CORP.
YUBA CONSOLIDATED INDUSTRIES, INC., YUBA MFG. DIV.

247 DRIVES, GEAR, SHAFT-MOUNTED

Allis Co., Louis
ALLIS-CHALMERS MFG. CO.
AMERICAN PULLEY CO.
Brown, Inc., David
Christian Engineers, J. D.
Cone-Drive Gears Div. Michigan Tool Co.
CONTINENTAL GIN CO. INDUSTRIAL DIV.
DODGE MFG. CO.
FALK CORP.
Foote Bros. Gear & Machine Corp.
Fuller Manufacturing Co.
GENERAL ELECTRIC CO. GEAR MOTOR & TRANSMISSION COMPONENTS DEPT.
HEWITT-ROBINS, INC.
Hirsch Bros. Machy. Co.
Imperial Electric Co.
Kanawha Mfg. Co.
LINK-BELT CO.
Lovejoy Flexible Coupling Co.
Master Electric Co.
Morse Chain Co.
NATIONAL IRON CO.
Perkins Machine & Gear Co.
PHILADELPHIA GEAR CORP.
Rockwell Spring & Axle Co. Timken-Detroit Axle Div.
Stephens-Adamson Mfg. Co.
Stroh Process Steel Co.
Tool Steel Gear & Pinion Co.
Universal Gear Div., Novo Pump & Engine Co.
U. S. Electrical Motors, Inc.
Wagner Electric Corp.
Western Gear Corp.
WESTINGHOUSE ELECTRIC CORP.
YUBA CONSOLIDATED INDUSTRIES, INC. YUBA MFG. DIV.

248 DRIVES, MAGNETIC & EDDY-CURRENT

Allis Co., Louis
Cutler-Hammer, Inc.
Dings Magnetic Separator Co.
Eaton Mfg. Co.
Electric Machinery Mfg. Co.
Fawick Airflex Co., Inc.
Whitney Chain Co.

249 DRIVES, VARIABLE SPEED

Allis Co., Louis
ALLIS-CHALMERS MFG. CO.
AMERICAN PULLEY CO.
American Standard Industrial Div.
Brown, Inc., David
Browning Mfg. Co.
Clark Controller Co.
CLARK EQUIPMENT CO. TRANSMISSION DIV.
DODGE MFG. CORP.
Cutler-Hammer, Inc.
Cleveland Worm & Gear Co.
Eaton Mfg. Co.
Electric Machinery Mfg. Co.
Electro Dynamic Div. General Dynamics Corp.
Foote Bros. Gear & Machine Corp.
Fuller Manufacturing Co.
GENERAL ELECTRIC CO. APPARATUS SALES DIV.
GENERAL ELECTRIC CO., GEAR MOTOR & TRANSMISSION COMPONENT DEPT.
GENERAL MOTORS CORP. ALLISON DIV.
HEWITT-ROBINS, INC.
Imperial Electric Co.
Lewellen Mfg. Co.
Lima Electric Motor Co.
LINK-BELT CO.
Lovejoy Flexible Coupling Co.
Marble Electric Corp.
Master Electric Co.
Morse Chain Co.
NATIONAL SUPPLY CO.
Oilgear Co.
PHILADELPHIA GEAR CO.
Reeves Pulley Co., Div. Reliance Electric & Engineering Co.
Reliance Electric & Engineering Co.
Rockwell Spring & Axle Co. Timken-Detroit Axle Div.
Sterling Electric Motors, Inc.
U. S. Electrical Motors, Inc.
U. S. RUBBER CO.
Vickers Inc.
Wagner Electric Corp.
Webb Co., Jervis B.
Western Gear Corp.
WESTINGHOUSE ELECTRIC CORP.
Wood's Sons Co., T. B.
Worthington Corp.

249A DROP BALLS (Quarries)

Georgia Iron Works Co.

250 DRYERS, HEATED DRUM

ALLIS-CHALMERS MFG. CO.
Bartlett & Snow Co., C. O.
Blue M. Electric Co.
Bruning Co., Inc. Charles
Canadian Locomotive Co., Ltd.
Davis Foundry & Machine Works
Denver Equipment Co.
GENERAL AMERICAN TRANSPORTATION CORP. LOUISVILLE DRYER DIV.
GOULD CO., GORDON I.
Hack Engineering Co.
HARDINGE CO., INC.
Hazemag USA Inc.
Heineken, Inc. W. P.
Hevi-Duty Electric Co.
Hirsch Bros. Machy. Co.
Holmes & Bros., Inc. Robert
IOWA MFG. CO.
JEFFREY MFG. CO.
KENNEDY-VAN SAUN MFG. & ENG. CORP.
LINK-BELT CO.
MINE & SMELTER SUPPLY CO., MFG. DIV.
NORDBERG MFG. CO.
Pioneer Engineering, Div. Poor & Co., Inc.
Rockwell Co. W. S.
Simpicity System Co.
Southwestern Engineering Co.
Standard Steel Corp.
STEARNS ROGER MFG. CO.
TRAYLOR ENGINEERING & MFG. CO.
Universal Dredge Mfg. Co.
Washington Machinery Co.

251 DRYERS, INFRA-RED

Booth Co.

Corning Glass Works
Fisher Scientific Co.
HEWITT-ROBINS, INC.
JEFFREY MFG. CO.
LINK-BELT CO.

252 DRYERS, VIBRATING PAN, ELECTRICALLY HEATED

Carrier Conveyor Corp.
JEFFREY MFG. CO.
LINK-BELT CO.
Syntron Co.

253 DUST COLLECTORS & PRECIPITATORS—does not include: Classifiers, Cyclone, Dry; Drill (rock) Dust Collectors; Filters, Air; Scrubbers, Air & Waste Gas

AMERICAN AIR FILTER CO., INC.
American Standard Industrial Div.
B-I-F Industries, Inc.
BUELL ENGINEERING CO.
Cincinnati Electrical Tool Co.
DIESEL ENERGY CORP.
DUCON INC.
Dustex Corp.
Fluor Products Co., Hartmann Div.
Fly Ash Arrestor Corp.
Fuller Co.
Hagan Chemicals & Controls, Inc. Divisions: Calgon Co., Hall Laboratories
Hazemag USA, Inc.
Heineken, Inc. W. P.
Hisey-Wolf Machine Co.
IOWA MFG. CO.
Johnson-March Corp.
JOY MFG. CO.
Kanawha Mfg. Co.
KENNEDY-VAN SAUN MFG. & ENG. CORP.
Kirk & Blum Mfg. Co.
Koppers Co., Inc. Metal Prod. Div.
MACHINERY CENTER, INC.
Mahon Co., R. C.
Majac Inc.
McNALLY PITTSBURG MFG. CORP.
MINE SAFETY APPLIANCES CO.
NORTHERN BLOWER CO.
Ogden Iron Works
Pangborn Corp.
Pioneer Engineering Div. Poor & Co. Inc.
Pulverizing Machinery Div., Metals Disintegrating Co., Inc.
Research-Cottrell, Inc.
Santa Fe Tank Div. Flour Products Co.
Schneible Co., Claude B.
SLY MFG. CO., W. W.
Standard Electrical Tool Co.
Stanley Co., Inc., William W.
U. S. Electrical Tool Co.
U. S. Hoffman Machinery Corp. Air Appliance Div.
WESTERN PRECIPITATION CORP.
WESTINGHOUSE ELECTRIC CORP. STURTEVANT DIV.
Wheelabrator Corp.
Wheeler Mfg. Co., C. H.

254 DUST SAMPLERS

Dustex Corp.
MINE SAFETY APPLIANCES CO.
Staplex Co. Air Sampler Div.
WESTERN PRECIPITATION CORP.

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255 ELECTRICAL BRUSHES

Carbon Engineering Corp.
Carbone Corp.
Helwig Co.
Keystone Carbon Co.
National Carbon Co. Union Carbide Co.
NATIONAL MINE SERVICE CO.
Northwestern Electric Co.
Ohio Carbon Co.
Pure Carbon Co.
Southern Carbon Brush Co.
Speer Carbon Co.
Stackpole Carbon Co.
WESTINGHOUSE ELECTRIC CORP.

256 ELECTRICAL CONDUIT, RACEWAYS & FITTINGS —also see Pipe

American Brass Co.
Appleton Electric Co.
Byers Co., A. M.
Circle Wire & Cable Corp.
Crouse Hinds Co.
Electrical Fittings Corp.
Flexaust Co.
Franklin Plastics Co.
General Cable Corp.
GENERAL ELECTRIC CO. CONDUIT PRODUCTS DEPT.
Gladding, McBean & Co.
Graybar Elec. Co., Inc.
Johns-Manville
Killark Electric Mfg. Co.
Kraloy Plastic Pipe Co., Inc.
Line Material Industries McGraw-Edison Co.
H. K. PORTER COMPANY, INC., NATIONAL ELECTRIC PRODUCTS DIV.
NATIONAL SUPPLY CO.
Newage Industries, Inc.
Parker Electrical Mfg. Co.
Pittsburgh Reflector Co.
Pyle-National Co.
Rattan Mfg. Co.
Rome Cable Corp.
Steel City Electric Co.
Steelduct Co.
Thomas & Betts Co.
Triangle Conduit & Cable Co., Inc.
U. S. RUBBER CO. MECHANICAL GOODS DIV.
V. V. Fittings Co.
Wadsworth Electric Mfg. Co.
Walker Brothers
WESTINGHOUSE ELECTRIC CORP.
Youngstown Sheet & Tube Co.

257 ELECTRIC BATTERIES, DRY & STORAGE

Auto-Lite Battery Corp.
Bowers Battery & Spark Plug Co.
Bright Star Industries
Burgess Battery Co., Div. Servel, Inc.
C & D Batteries, Inc.
Carbone Corp.
Edison, Inc., T. A. Edison Storage Battery Div.
ELECTRIC STORAGE BATTERY CO. EXIDE INDUSTRIAL DIV.
General Cable Corp.
GOODRICH CO., B. F. TRUCK & BUS TIRE DEPT.
GOULD-NATIONAL BATTERIES, INC.
Graybar Elec. Co., Inc.
K. W. Battery Co.
Lafayette Radio Corp.
National Carbon Co. Union Carbide Corp.
RAY-O-VAC CO., DIV. ELECTRIC STORAGE BATTERY CO.
Yardney Electric Corp.

258 ELECTRIC BATTERY CHARGERS

American Marc, Inc.
American Rectifier Corp. Selenicharger Div.
Automatic Switch Co.
Bowers Battery & Spark Plug Co.
C & D Batteries, Inc.
Control Corp.
Electric Specialty Co.
ELECTRIC STORAGE BATTERY CO. EXIDE INDUSTRIAL DIV.
General Cable Corp.
GENERAL ELECTRIC CO. APPARATUS SALES DIV.
General Nuclear Corp.
GOODRICH CO., B. F. TRUCK & BUS TIRE DEPT.
GOULD-NATIONAL BATTERIES, INC
Graybar Elec. Co., Inc.
Hertner Electric Co.
Hobart Bros. Co.
Hose-McCann Telephone Co.
Ironton Engine Co.
K. W. Battery Co.
Kersey Mfg. Co., Inc.
Knopp, Inc.
Lafayette Radio Corp.
Lincoln Electric Co.
Marble Electric Corp.
Marquette Mfg. Co., Inc.
NATIONAL MINE SERVICE CO.
Northwestern Electric Co.
Onan & Sons, Inc., D. W.
Perkin Engineering Corp.
Quick Charge Inc.
Syntron Co.
WESTINGHOUSE ELECTRIC CORP.
Yardney Electric Corp.

259 ELECTRIC BATTERY TRANSFER RACKS

Graybar Elec. Co., Inc.

260 ELECTRIC CABLE & WIRE—other than below

Alphaduct Wire & Cable Co.
American Brass Co.
AMERICAN STEEL & WIRE DIV. U. S. STEEL CORP.
ANACONDA WIRE & CABLE CO.
Ansonia Wire & Cable Co.
Auto-Lite Battery Corp.
Chester Cable Corp., Subsidiary Miami Copper Co.
Circle F Mfg. Co.
Circle Wire & Cable Corp.
Collyer Insulated Wire Co.
Copperweld Steel Co.
Crescent Insulated Wire & Cable Co.
Ettco Wire & Cable Corp.
Flocker & Co., John
General Cable Corp.
GENERAL ELECTRIC CO., WIRE & CABLE PRODUCTS DEPT.
Graybar Elec. Co., Inc.
Kerite Co.
Lafayette Radio Corp.
MACHINERY CENTER INC.
H. K. PORTER CO., INC., NATIONAL ELECTRIC PRODUCTS DIV.
NATIONAL MINE SERVICE CO.
Okonite Co., Subsidiary, Kennecott Copper Corp.
Paranite Wire & Cable Div. Essex Wire Corp.
PHELPS DODGE COPPER PRODUCTS CORP.
Pickard Industries, Inc. Central Mine Supply Co., Div.
Reynolds Metals Co.
Rockbestos Products Corp.
ROEBLING'S SONS CORP., JOHN A. SUBSIDIARY OF COLORADO FUEL & IRON CO.
Rome Cable Corp.
SIMPLEX WIRE & CABLE CO.
TENNESSEE COAL & IRON DIV. U. S. STEEL CORP.
Triangle Conduit & Cable Co., Inc.
Walker Brothers
Western Insulated Wire Co.

261 ELECTRIC CABLE, ARMORED

Aluminum Co. of America
AMERICAN STEEL & WIRE DIV. OF U. S. STEEL CORP.
ANACONDA WIRE & CABLE CO.
Ansonia Wire & Cable Co.
Chester Cable Corp., Subsidiary Miami Copper Co.
Circle Wire & Cable Corp.
Collyer Insulated Wire Co.
Crescent Insulated Wire & Cable Co.
Ettco Wire & Cable Corp.
Flocker & Co., John
General Cable Corp.
GENERAL ELECTRIC CO., WIRE & CABLE PRODUCTS DEPT.
Graybar Elec. Co., Inc.
Kaiser Aluminum & Chemical Sales, Inc.
Kerite Co.
MACHINERY CENTER INC.
H. K. PORTER COMPANY, INC., NATIONAL ELECTRIC PRODUCTS DIV.
Okonite Co., Subsidiary Kennecott Copper Corp.
Paranite Wire & Cable Div. Essex Wire Corp.
PHELPS DODGE COPPER PRODUCTS CORP.
Pickard Industries Inc., Central Mine Supply Co., Div.
Pitnam Electric Products Co., Pirelli Power Cable Dept.
Rochester Ropes, Inc.
Rockbestos Products Corp.
ROEBLING'S SONS CORP., JOHN A. SUBSIDIARY OF COLORADO FUEL & IRON CORP.
Rome Cable Corp.
SIMPLEX WIRE & CABLE CO.
TENNESSEE COAL & IRON DIV. U. S. STEEL CORP.
Triangle Conduit & Cable Co., Inc.
U. S. STEEL CORP COLUMBIA-GENEVA STEEL DIV

262 ELECTRIC CABLE, NON METALLIC SHEATHED

Aluminum Co. of America
AMERICAN STEEL & WIRE DIV. U. S. STEEL CORP.
ANACONDA WIRE & CABLE CO.
Ansonia Wire & Cable Co.
Auto-Lite Battery Corp.
Chester Cable Corp., Subsidiary Miami Copper Co.
Circle Wire & Cable Corp.
Collyer Insulated Wire Co.
Crescent Insulated Wire & Cable Co.
Ettco Wire & Cable Corp.
Flocker & Co., John
General Cable Corp.
GENERAL ELECTRIC CO., WIRE & CABLE PRODUCTS DEPT.
Graybar Elec. Co., Inc.
Kerite Co.
H. K. PORTER COMPANY, INC., NATIONAL ELECTRIC PRODUCTS DIV.
Okonite Co., Subsidiary Kennecott Copper Corp.
Paranite Wire & Cable Div. Essex Wire Corp.
PHELPS DODGE COPPER PRODUCTS CORP.
Pickard Industries, Inc. Central Mine Supply Co., Div.
Rockbestos Products Corp.
Rome Cable Corp.
SIMPLEX WIRE & CABLE CO.
TENNESSEE COAL & IRON DIV. U. S. STEEL CORP.
Triangle Conduit & Cable Co., Inc.
U. S. STEEL CORP. COLUMBIA-GENEVA STEEL DIV.
Walker Brothers
Western Insulated Wire Co.

263 ELECTRIC CABLE, TRAILING

Aluminum Co. of America
AMERICAN STEEL & WIRE DIV. U. S. STEEL CORP.
ANACONDA WIRE & CABLE CO.
Ansonia Wire & Cable Co.
Circle Wire & Cable Corp.
Collyer Insulated Wire Co.
Crescent Insulated Wire & Cable Co.
General Cable Corp.
GENERAL ELECTRIC CO., WIRE & CABLE PRODUCTS DEPT.
Graybar Elec. Co., Inc.
NATIONAL MINE SERVICE CO.
Okonite Co., Subsidiary Kennecott Copper Corp.
Paranite Wire & Cable Div. Essex Wire Corp. Pirelli Power Cable Dept.
Pitnam Electric Products Co.
PHELPS DODGE COPPER PRODUCTS CORP.
Pickard Industries Inc. Central Mine Supply Co., Div.
ROEBLING'S SONS CORP., JOHN A. SUBSIDIARY OF COLORADO FUEL & IRON CO.
Rome Cable Corp.
SIMPLEX WIRE & CABLE CO.
TENNESSEE COAL & IRON DIV. U. S. STEEL CORP.
Triangle Conduit & Cable Co., Inc.
U. S. STEEL CORP. COLUMBIA-GENEVA STEEL DIV.
Western Insulated Wire Co.

264 ELECTRIC CABLE ACCESSORIES & FITTINGS

Aluminum Co. of America
ANACONDA WIRE & CABLE CO.
Anderson Mfg. Co., Albert & J. M.
Appleton Electric Co.
Auto-Lite Battery Corp.
Burndy Corp.
Electrical Fittings Corp.
Elreco Corp.
Federal Pacific Electric Co., Pacific Switchgear Div.
G & W Electric Specialty Co.
Graybar Elec. Co., Inc.
JOY MFG. CO.
Memco Engineering & Mfg. Co.
NATIONAL MINE SERVICE CO.
Ohio Brass Co.
Pickard Industries, Inc. Central Mine Supply Co. Div.
H. K. PORTER COMPANY, INC., NATIONAL ELECTRIC PRODUCTS DIV.
Powercraft Corp.
Pyle-National Co.
Rattan Mfg. Co.
Steel City Electric Co.
Thomas & Betts Co.

265 ELECTRIC CABLE SPLICERS & VULCANIZERS

AMERICAN MINE DOOR CO.
Clark Controller Co.
Deltron Electric Products, Inc.
Flood City Brass & Elec. Co.
Irvington Div. Minnesota Mining & Mfg. Co.
JOY MFG. CO.
MINE SAFETY APPLIANCES CO.
Minnesota Mining & Mfg. Co.
Pickard Industries Inc. Central Mine Supply Co., Div.

266 ELECTRIC GENERATORS—does not include: Power Plants, engine- or motor-generator sets, or Rectifiers

ALLIS-CHALMERS MFG. CO.
Allis Co., Louis
American Marc, Inc.
Auto-Lite Battery Corp.
Century Electric Co.
Columbia Electric Mfg. Co.
Continental Electric Co., Inc.
Electric Machinery Mfg. Co.
Electric Specialty Co.
Electro Dynamic Div., General Dynamics Corp.
Elliott Co.
FAIRBANKS, MORSE & CO.
GENERAL ELECTRIC CO. APPARATUS

SALES DIV.
Graybar Elec. Co. Inc.
Ideal Electric & Mfg. Co.
Hertner Electric Co.
Imperial Electric Co.
Kato Engineering Co.
Kurz & Root Co.
Leland Electric Co., Div. American Machine & Foundry Co.
Marathon Electric Mfg. Corp.
Marble Card Electric Corp.
Master Electric Co.
Miehle Printing Press & Mfg. Co. Star-Kimble Motor Div.
Northwestern Electric Co.
Ohio Brass Co.
Onan & Sons, Inc., D. W.
Troy Engine & Machine Co.
WESTINGHOUSE ELECTRIC CORP.
Wincharger Corp.

267 ELECTRIC GENERATING POWER PLANTS, MOBILE & MOVABLE

Alco Products, Inc.
ALLIS-CHALMERS MFG. CO.
American Marc, Inc.
Beech Aircraft Corp.
CATERPILLAR TRACTOR CO.
CHICAGO PNEUMATIC TOOL CO.
Climax Engine Mfg. Co., Div. Waukesha Motor Co.
DETROIT DIESEL ENGINE DIV. GENERAL MOTORS CORP.
DIESEL ENERGY CORP.
FAIRBANKS, MORSE & CO.
GENERAL ELECTRIC CO. APPARATUS SALES DIV.
GM DIESEL, DETROIT DIESEL ENGINE DIV., GENERAL MOTORS CORP.
Graybar Elec. Co., Inc.
HARNISHFEGER CORP. P & H DIESEL DIV.
Hobart Bros. Co.
Homelite Div., Textron Inc.
Ideal Electric & Mfg. Co.
Kato Engineering Co.
Kurz & Root Co.
Lincoln Electric Co.
Lister-Blackstone, Inc.
Marathon Electric Mfg. Corp.
Miehle Printing Press & Mfg. Co. Star-Kimble Motors Div.
Milwaukee Electric Tool Corp.
Murphy Diesel Co.
NORDBERG MFG. CO.
Northwestern Electric Co.
Onan & Sons, Inc., D. W.
Pyle-National Co.
Ready Power Co.
Sheppard Co., Inc., R. H.
Thor Power Tool Co.
Universal Motor Co.
Waukesha Motor Co.
WESTINGHOUSE ELECTRIC CORP.
WHITE DIESEL ENGINE DIV. WHITE MOTOR CO.
Wincharger Corp.
WITTE ENGINE WORKS, OIL WELL SUPPLY DIV. U. S. STEEL CORP.

268 ELECTRIC GENERATING POWER PLANTS, STATIONARY

Alco Products, Inc.
ALLIS-CHALMERS MFG. CO.
American Marc, Inc.
CATERPILLAR TRACTOR CO.
Condenser Service & Engineering Co.
Continental Electric Co., Inc.
Cooper-Bessemer Corp.
DETROIT DIESEL ENGINE DIV. GENERAL MOTORS CORP.
DIESEL ENERGY CORP.
Electric Machinery Mfg. Co.
FAIRBANKS, MORSE & CO.
GENERAL ELECTRIC CO., APPARATUS SALES DIV.
GM DIESEL, DETROIT DIESEL ENGINE DIV., GENERAL MOTOR CORP.
Graybar Elec. Co., Inc.
HARNISCHFEGER CORP., P & H DIESEL DIV.
Hertner Electric Co.
Hobart Bros. Co.
Ideal Electric & Mfg. Co.
Kato Engineering Co.
Lister-Blackstone Inc.
Murphy Diesel Co.
NORDBERG MFG. CO.
Northwestern Electric Co.
Onan & Sons, Inc., D. W.
Pyle-National Co.
Ready Power Co.
Terry Steam Turbine Co.
Universal Motor Co.
Waukesha Motor Co.
WESTINGHOUSE ELECTRIC CORP.
WHITE DIESEL ENGINE DIV. WHITE MOTOR CO.
Wincharger Corp.
WITTE ENGINE WORKS OIL WELL SUPPLY DIV. U. S. STEEL CORP.

269 ELECTRIC MOTORS — does not include Gear Motors

Acme Machinery Co.
ALLIS-CHALMERS MFG. CO.
Allis Co., Louis
Armor Electric Mfg. Co.
Auto-Lite Battery Corp.
Century Electric Co.
Cleveland Electric Motor Co.
Continental Electric Co., Inc.
Diehl Mfg. Co.
Electric Machinery Mfg. Co.
Electric Specialty Co.
Electro Dynamic Div. General Dynamics Corp.
Elliott Co.
FAIRBANKS, MORSE & CO.
GENERAL ELECTRIC CO. APPARATUS SALES DIV.
Graybar Elec. Co., Inc.
Hertner Electric Co.
Howell Electric Motors Co.
Ideal Electric & Mfg. Co.
Imperial Electric Co.
Kato Engineering Co.
Kurz & Root Co.
Lafayette Radio Corp.
Leland Electric Co., Div. American Machine & Foundry Co.
Lima Electric Motor Co.
Lincoln Electric Co.
Marathon Electric Mfg. Corp.
Marble Card Electric Corp.
Master Electric Co.
Miehle Printing Press & Mfg. Co. Star-Kimble Motor Div.
Northwestern Electric Co.
Ohio Electric Mfg. Co.
Peerless Electric Co.
Pickard Industries, Inc. Central Mine Supply Co., Div.
Reliance Electric & Engineering Co.
Robbins & Myers, Inc., Motor Div.
Smith Co., A. O.
Sterling Electric Motors, Inc.
U. S. Electric Motors, Inc.
Wagner Electric Corp.
Western Gear Corp.
WESTINGHOUSE ELECTRIC CORP.
Wincharger Corp.

270 ELECTRIC MOTORS, PROTECTED

Acme Machinery Co.
ALLIS-CHALMERS MFG. CO.
Allis Co., Louis
Armor Electric Mfg. Co.
Baldor Electric Co.
Century Electric Co.
Cleveland Electric Motor Co.
Continental Electric Co., Inc.
Diehl Mfg. Co.
Electric Machinery Mfg. Co.
Electric Specialty Co.
Electro Dynamic Div. General Dynamics Corp.
Elliott Co.
FAIRBANKS, MORSE & CO.
GENERAL ELECTRIC CO. APPARATUS SALES DIV.
Graybar Elec. Co., Inc.
Howell Electric Motors Co.
Ideal Electric & Mfg. Co.
Imperial Electric Co
Kurz & Root Co.
Lima Electric Motor Co.
Lincoln Electric Co.
Marathon Electric Mfg. Corp.
Marble Card Electric Corp.
Master Electric Co.
Miehle Printing Press & Mfg. Co. Star-Kimble Motor Div.
Northwestern Electric Co.
Ohio Electric Mfg. Co.
Peerless Electric Co.
Reliance Electric & Engineering Co.
Robbins & Myers, Inc.
Sterling Electric Motors, Inc.
U. S. Electrical Motors, Inc.
Wagner Electric Corp.
Western Gear Corp.
WESTINGHOUSE ELECTRIC CORP.
Wincharger Corp.

271 ELECTRIC MOTOR CONTROLS & STARTERS—also see: Controls; Electric Resistors; Electric Switchgear

Acme Machinery Co.
Allen-Bradley Co.
ALLIS-CHALMERS MFG. CO.
Allis Co., Louis
Armor Electric Mfg. Co.
Arrow Hart & Hegeman Electric Co.
Auto-Lite Battery Corp.
Automatic Switch Co.
Black & Decker Mfg. Co.
Bristol Co.
Carpco Mfg., Inc.
Clark Controller Co.
Cutler-Hammer, Inc.
Electric Controller & Mfg. Co. Div. Square D. Co.
Electric Materials Co.
Electrical Machinery Mfg. Co.
Ensign Electric & Mfg. Co.
Federal Pacific Electric Co.
GENERAL ELECTRIC CO. APPARATUS SALES DIV.
General Equipment & Mfg. Co.
Graybar Elec. Co., Inc.
Guyan Machy. Co.
Ideal Electric & Mfg. Co.
Kato Engineering Co.
Kurz & Root Co.
NATIONAL MINE SERVICE CO.
Northwestern Electric Co.
Ohio Brass Co.
Parker Electrical Mfg. Co.
Pyle-National Co.
Reliance Electric & Engineering Co.
WESTINGHOUSE ELECTRIC CORP.

272 ELECTRIC RECTIFIERS, MECHANICAL

GENERAL ELECTRIC CO. APPARATUS SALES DIV.
I-T-E Circuit Breaker Co.
Kersey Mfg. Co., Inc.
WESTINGHOUSE ELECTRIC CORP.

273 ELECTRIC RECTIFIERS, MERCURY ARC

ALLIS-CHALMERS MFG. CO.
GENERAL ELECTRIC CO. APPARATUS SALES DIV.
GENERAL ELECTRIC CO. IND. HAULAGE DIV. LOCO. & CAR EQUIP. DIVS.
Reliance Electric & Engineering Co.
WESTINGHOUSE ELECTRIC CORP.

274 ELECTRIC RECTIFIERS, MOTOR - GENERATOR SETS

ALLIS-CHALMERS MFG. CO.
Allis Co., Louis
Columbia Electric Mfg. Co.
Continental Electric Co., Inc.
Electro Dynamic Div., General Dynamics Corp.
GENERAL ELECTRIC CO. APPARATUS SALES DIV.
Graybar Elec. Co., Inc.
GENERAL MOTORS CORP. ELECTRO-MOTIVE DIV.
Hertner Electric Co.
Ideal Electric & Mfg. Co.
Kato Engineering Co.
Kersey Mfg. Co., Inc.
Kurz & Root Co.
Leland Electric Co., Div. American Machine & Foundry Co.
Marathon Electric Mfg. Corp.
Marble Card Electric Corp.
Master Electric Co.
Miehle Printing Press & Mfg. Co. Star-Kimble Motor Div.
Northwestern Electric Co.
Reliance Electric & Engineering Co.
Sangamo Electric Co.
WESTINGHOUSE ELECTRIC CORP.

275 ELECTRIC RECTIFIERS, SELENIUM & RARE METAL

ALLIS-CHALMERS MFG. CO.
American Rectifier Corp.
Clark Controller Co.
GENERAL ELECTRIC CO. APPARATUS SALES DIV.
General Nuclear Corp.
Graybar Elec. Co., Inc.
I-T-E Circuit Breaker Co.
K. W. Battery Co.
Kersey Mfg. Co., Inc.
Knopp, Inc.
Lafayette Radio Corp.
Perkin Engineering Co.
Shrader Co., F. W.
Syntron Co.
Union Switch & Signal Div., Westinghouse Air Brake Co.
VARIAN ASSOCIATES
WESTINGHOUSE ELECTRIC CORP.
Whiting Corp.

276 ELECTRIC RECTIFIERS, VACUUM TUBE (ELECTRONIC)

ALLIS-CHALMERS MFG. CO.
Baldor Electric Co.
General Equipment & Mfg. Co.
Graybar Elec. Co., Inc.
Lafayette Radio Corp.
Reliance Electric & Engineering Co.
VARIAN ASSOCIATES
WESTINGHOUSE ELECTRIC CORP.

277 ELECTRIC RECTIFIERS, SYNCHRONOUS CONVERTER

ALLIS-CHALMERS MFG. CO.
GENERAL ELECTRIC CO. APPARATUS SALES DIV.
Graybar Elec. Co., Inc.
Kato Engineering Co.
Universal Dredge Mfg. Co.
WESTINGHOUSE ELECTRIC CORP.

278 ELECTRIC RECTIFIERS, SPECIAL OR OTHER THAN ABOVE

ALLIS-CHALMERS MFG. CO.
American Rectifier Corp.
Carpco Manufacturing, Inc.
CURTISS-WRIGHT CORP. ELECTRONICS DIV.
GENERAL ELECTRIC CO. APPARATUS SALES DIV.
General Equipment & Mfg. Co.
Graybar Elec. Co., Inc.
Northwestern Electric Co.
Perkin Engineering Corp.
WESTINGHOUSE ELECTRIC CORP.

279 ELECTRIC RESISTORS & RHEOSTATS

Allen-Bradley Co.
Clark Controller Co.
Cutler-Hammer Inc.
GENERAL ELECTRIC CO., APPARATUS SALES DIV.
Guyan Machy. Co.
Lafayette Radio Corp.
Ohio Carbon Co.
Western Instruments, Div. Daystrom, Inc.
WESTINGHOUSE ELECTRIC CORP.

280 ELECTRIC SWITCHGEAR & SWITCHES — also see: Electrical brushes; Controls, Electrical; Meters, Electrical; Electric Trolley Accessories

Allen-Bradley Co.
ALLIS-CHALMERS MFG. CO.
Anderson Mfg. Co., Albert & J. M.
Arrow Hart & Hegeman Electric Co.
Automatic Switch Co.
Bethlehem Foundry & Machine Co.
Bulldog Electric Products Co.
CHEATHAM ELECTRIC SWITCHING DEVICE CO.
Circle F Mfg. Co.
Clark Controller Co.
Cutler-Hammer, Inc.
Delta-Star Electric Div. H. K. Porter Company, Inc.
Durakool, Inc.
Electric Controller & Mfg. Co. Div. Square D. Co.
Electronic Machinery Mfg. Co.
Federal Pacific Electric Co.
G & W Electric Specialty Co.
GENERAL ELECTRIC CO., APPARATUS SALES DIV.
General Equipment & Mfg. Co.
General Switch Co., Div. Norbute Div.
Graybar Elec. Co., Inc.
Guyan Machy. Co.
Hart Mfg. Co.
Heinemann Electric Co.
I-T-E Circuit Breaker Co.
Ideal Electric Mfg. Co.
Kolton Electric Mfg. Co.
Kurz & Root Co.
Lake Shore Electric Mfg. Corp.
Line Material Industries McGraw-Edison Co.
Memco Engineering & Mfg. Co.
MINNEAPOLIS-HONEYWELL REGULATOR CO. MICRO SWITCH DIV.
NACHOD & U. S. SIGNAL CO.
NATIONAL FILTER MEDIA CORP.
Northwestern Electric Co.
Parker Electrical Mfg. Co.
Powercraft Corp.
V. V. Fittings Co.
Wadsworth Electric Mfg. Co.
WESTINGHOUSE ELECTRIC CORP.

281 ELECTRIC TRANSFORMERS — also see Unit Substations below

ALLIS-CHALMERS MFG. CO.
Burton Equipment Co., Inc.
Eisler Engineering Co.
Federal Pacific Electric Co.
GENERAL ELECTRIC CO. APPARATUS SALES DIV.
Graybar Elec. Co., Inc.
Hevi-Duty Electric Co.
I-T-E Circuit Breaker Co.
Knopp, Inc.

Kolton Electric Mfg. Co.
Kuhlman Electric Co.
Lafayette Radio Corp.
Line Material Industries McGraw-Edison Co.
Moloney Electric Co.
Northwestern Electric Co.
Sangamo Electric Co.
Sorgel Electric Co.
Southwestern Industrial Electronics Co.
Standard Transformer Co.
Wagner Electric Corp.
WESTINGHOUSE ELECTRIC CORP.

282 ELECTRIC TROLLEY ACCESSORIES

Anderson Mfg. Co., Albert & J. M.
Arizona Testing Laboratories
Charlton Laboratories
CHEATHAM ELECTRIC SWITCHING DEVICE CO.
Deltron Electric Products, Inc.
Duquesne Mine Supply Co.
Electric Materials Co.
Elreco Corp.
Flood City Brass & Elec. Co.
Forker Corp.
General Equipment & Mfg. Co.
Gering Products, Inc.
Guyon Machinery Co.
Hales Co., W. M.
NACHOD & U. S. SIGNAL CO.
NATIONAL FILTER MEDIA CORP.
Ohio Brass Co.
Root & Simpson, Inc.
Star Brass Works

283 ELECTRIC UNIT SUBSTATIONS

ALLIS-CHALMERS MFG. CO.
BullDog Electric Products Co.
Ensign Electric & Mfg. Co.
Federal Pacific Electric Co.
GENERAL ELECTRIC CO. APPARATUS SALES DIV.
Graybar Elec. Co., Inc.
Hevi-Duty Electric Co.
I-T-E Circuit Breaker Co.
Kolton Electric Mfg. Co.
Kuhlman Electric Co.
Line Material Industries McGraw-Edison Co.
Memco Engineering & Mfg. Co.
Moloney Electric Co.
Sorgel Electric Co.
Standard Transformer Co.
Wagner Electric Corp.
WESTINGHOUSE ELECTRIC CORP.

284 ELECTRIC VOLTAGE REGULATORS

ALLIS-CHALMERS MFG. CO.
Allis Co., Louis
Auto-Lite Battery Corp.
CURTISS-WRIGHT CORP. ELECTRONICS DIV.
Electric Machinery Mfg. Co.
GENERAL ELECTRIC CO. APPARATUS SALES DIV.
Graybar Elec. Co., Inc.
Lafayette Radio Corp.
Line Material Industries McGraw-Edison Co.
Marathon Electric Mfg. Corp.
Moloney Electric Co.
Northwestern Electric Co.
Perkin Engineering Co.
Reliance Electric & Engineering Co.
WESTINGHOUSE ELECTRIC CORP.

285 ELEVATORS, PLANT BUILDINGS (MAN & MATERIAL)—does not include: Conveyors; Hoists (Mine)

Bartlett & Snow Co., C. O.
Bodinson Manufacturing Co., Inc.
CONNELLSVILLE MFG. & MINE SUPPLY CO.
Hapman Conveyors, Inc.
O. K. Machinery Div. John C. Motter Printing Press Co.
Stephens-Adamson Mfg. Co.
Transport Trailers, Inc.
WESTINGHOUSE ELECTRIC CORP.

286 ENGINES, DIESEL

Alco Products, Inc.
ALLIS-CHALMERS MFG. CO.
American Marc, Inc.
Burgess Battery Co., Div. Servel Inc.
Canadian Locomotive Co., Ltd.
CASE CO., J. I. INDUSTRIAL DIV
CATERPILLAR TRACTOR CO.
CHICAGO PNEUMATIC TOOL CO.
Compton, Inc.
Continental Motors Co.
Cooper-Bessemer Corp.
Cummins Engine Co., Inc.
DIESEL ENERGY CORP.
FAIRBANKS, MORSE & CO.
GARDNER DENVER CO.
GM DIESEL, DETROIT DIESEL ENGINE DIV., GENERAL MOTORS CORP.
GENERAL MOTORS CORP. ELECTRO-MOTIVE DIV.
HARNISCHFEGER CORP.
HARNISCHFEGER CORP. P & H DIESEL DIV.
HERCULES MOTORS CORP.
INGERSOLL-RAND CO.
INTERNATIONAL HARVESTER EXPORT CO.
Lister-Blackstone, Inc.
Murphy Diesel Co.
Newage Industries, Inc.
NORDBERG MFG. CO.
Oliver Corp.
Onan & Sons, Inc., D. W.
Page Engineering Co.
Sheppard Co., Inc., R. H.
Waukesha Motor Co.
WITTE ENGINE WORKS OIL WELL SUPPLY DIV. U. S. STEEL CORP.
WHITE DIESEL ENGINE DIV. WHITE MOTOR CO.
Worthington Corp.

287 ENGINES, GAS & GASOLINE

ALLIS-CHALMERS MFG. CO.
American Marc, Inc.
Briggs & Stratton Corp.
Canadian Locomotive Co., Ltd.
CASE CO., J. I. INDUSTRIAL DIV.
CATERPILLAR TRACTOR CO.
CHICAGO PNEUMATIC TOOL CO.
Continental Motors Co.
Cooper-Bessemer Corp.
Dean Hill Pump Co.
DIESEL ENERGY CORP.
FAIRBANKS, MORSE & CO.
FORD MOTOR CO.
HERCULES MOTORS CORP.
INTERNATIONAL HARVESTER EXPORT CO.
KW-DART TRUCK CO.
Mustang Motor Products Corp.
NORDBERG MFG. CO.
Oliver Corp.
Onan & Sons, Inc., D. W.
REO MOTORS DIV. WHITE MOTOR CO.
Solar Aircraft Co.
Waukesha Motor Co.
Westinghouse Air Brake Co.
WHITE DIESEL ENGINE DIV. WHITE MOTOR CO.
Wisconsin Motor Corp.
WITTE ENGINE WORKS OIL WELL SUPPLY DIV. U. S. STEEL CORP.

288 ENGINES, HYDRAULIC TURBINE

ALLIS-CHALMERS MFG. CO.
Davis Foundry & Machine Works
Leffel & Co., James

289 ENGINES, STEAM

Condenser Service & Engineering Co.
Dean Hill Pump Co.
Pyle-National Co.
Skinner Engine Co.
Troy Engine & Machine Co.

290 ENGINE EXHAUST SCRUBBERS

Drott Mfg. Co.
EIMCO CORP.
GENERAL ELECTRIC CO. INC. HAULAGE DIV. LOCO. & CAR EQUIP. DIVS.
INTERNATIONAL HARVESTER EXPORT CO.
Landis Steel Co.
Robinson Ventilating Co.
Ruth Co.
STANDARD MACHINERY CO.
Telluride Iron Works Co.

291 EXCAVATORS, BUCKET WHEEL

BARBER-GREENE CO.
BUCYRUS-ERIE CO.
Gar Wood Industries, Inc.
MINE & SMELTER SUPPLY CO.

292 EXCAVATORS, CLAM SHELL & GRAB CRANE

AMERICAN HOIST & DERRICK CO.
AUSTIN-WESTERN CONSTRUCTION EQUIPMENT DIV. BALDWIN-LIMA-HAMILTON CORP.
BALDWIN-LIMA-HAMILTON CORP., LIMA WORKS, CONSTRUCTION EQUIPMENT DIV.
Bay City Shovels, Inc.
BUCYRUS-ERIE CO.
CLARK EQUIPMENT CO. CONSTRUCTION MACHINERY DIV.
Gar Wood Industries, Inc.
HARNISCHFEGER CORP.
Hyster Co.
Insley Manufacturing Corp.
Koehring Div. of Koehring Co.
Link-Belt Speeder Corp.
MANITOWOC ENGINEERING CORP.
MARION POWER SHOVEL CO.
NORTHWEST ENGINEERING CO.
Schield Bantam Co.
Thew Shovel Co.
Unit Crane & Shovel Corp.
Yaun Mfg. Co., Inc.

293 EXCAVATORS, DIPPER SHOVEL

AMERICAN HOIST & DERRICK CO.
BALDWIN-LIMA-HAMILTON CORP., LIMA WORKS, CONSTRUCTION EQUIPMENT DIV.
Bay City Shovels, Inc.
BUCYRUS-ERIE CO.
CLARK EQUIPMENT CO. CONSTRUCTION MACHINERY DIV.
Gar Wood Industries, Inc.
HARNISHFEGER CORP.
Insley Mfg. Corp.
Koehring Div. of Koehring Co.
Link-Belt Speeder Corp.
MANITOWOC ENGINEERING CORP.
MARION POWER SHOVEL CO.
NORTHWEST ENGINEERING CO.
Pettibone Mulliken Corp.
Quick-Way Truck Shovel Co.
Schield Bantam Co.
Thew Shovel Co.
Unit Crane & Shovel Corp.

294 EXCAVATORS, DRAGLINE CRANE

AMERICAN HOIST & DERRICK CO.
BALDWIN-LIMA-HAMILTON CORP., LIMA WORKS, CONSTRUCTION EQUIPMENT DIV.
Bay City Shovels, Inc.
BUCYRUS-ERIE CO.
CLARK EQUIPMENT CO. CONSTRUCTION MACHINERY DIV.
Gar Wood Industries, Inc.
HARNISCHFEGER CORP.
Insley Manufacturing Corp.
Koehring Div. of Koehring Co.
Link-Belt Speeder Corp.
MANITOWOC ENGINEERING CORP.
MARION POWER SHOVEL CO.
NORTHWEST ENGINEERING CO.
Page Engineering Co.
Quick-Way Truck Shovel Co.
Schield Bantam Co.
Thew Shovel Co.
Unit Crane & Shovel Corp.
Yaun Mfg. Co., Inc.

295 EXCAVATOR, DRAGLINE TOWER

EIMCO CORP.
SAUERMAN BROS., INC.

(EXPLORATION EQUIPMENT — see: Surveying Equipment; Food, Packaged Kits; Tarpaulins; Geologist's Equip.; Geophysical Instruments; Transits, Pocket)

296 (EXPLOSIVES — see Blasting Compounds)

F

297 FANS & BLOWERS, AIR & GAS

AMERICAN AIR FILTER CO., INC.
American Machine & Metals, Inc. De Bothezat Fans Div.
American Standard Industrial Div.
Binks Mfg. Co.
Buffalo Forge Co.
Chelsea Fan & Blower Co.
Clarage Fan Co.
COPPUS ENGINEERING CO.
DeLaval Steam Turbine Co.
Diehl Mfg. Co.
Duriron Co., Inc.
Fly Ash Arrestor Corp.
Fuller Co.
Guyan Machy. Co.
Hartzell Propeller Fan Co.
Hauck Mfg. Co.
Herold Mfg. Co.
Ilg Electric Ventilating Co.
INGERSOLL-RAND CO.
JEFFREY MFG. CO.
JOY MFG. CO.
KENNEDY-VAN SAUN MFG. & ENG. CORP.
Koppers Co. Inc.
Lamson Corp.
LEHIGH FAN & BLOWER CO. & SUTORBILT CORP., FULLER CO., SUBSIDIARY GENERAL AMERICAN TRANSPORTATION CORP.
Martin Fan & Blower Co.
Maschinenfabrik Rudolf Hausherr & Soehne, GmbH c/o B. J. Nykerk Corp.
McNALLY PITTSBURG MFG. CORP.
Moore Co.
NORTHERN BLOWER CO.
Peerless Electric Co.
Robbins & Myers, Inc., Propellair Div.
Robinson Ventilating Co.
ROOTS-CONNERSVILLE BLOWER DIV. DRESSER INDUSTRIES INC.
Sanford-Day Iron Works, Inc.
Spencer Turbine Co.
Standard Elec. Mfg. Co., Inc.
U. S. Hoffman Machinery Corp. Air Appliance Div.
Western Gear Corp.
WESTINGHOUSE ELECTRIC CORP.
WESTINGHOUSE ELECTRIC CORP. STURTEVANT DIV.
Wing Mfg. Co., L. J.

298 FASTENERS—SCREWS, BOLTS, NAILS, SPIKES, NUTS, WASHERS, ETC. —does not include: Rock & Roof Bolts; Timber Connectors

Ackerman-Johnson Co.
Allied Steel & Tractor Products, Inc.
AMERICAN STEEL & WIRE DIV. U. S. STEEL CORP.
Ampco Metal, Inc.
Bethlehem Pacific Coast Steel Corp.
BETHLEHEM STEEL CO., INC.
Bristol Co.
Chicago Expansion Bolt Co.
COLUMBIA-GENEVA STEEL DIV., U. S. STEEL CORP.
Dicke Tool Co.
Dominion Steel & Coal Corp., Ltd.
Elastic Stop Nut Corp. of America
Frank, M. K.
General Steel Warehouse Co., Inc. Gensco Tool Div.
Gibraltar Equipment & Mfg. Co.
JONES & LAUGHLIN STEEL CORP.
Lamson & Sessions Co.
Lewis Bolt & Nut Co.
Painut Co.
Pickard Industries, Inc. Central Mine Supply Co., Div.
Pittsburgh Screw & Bolt Co.
Pittsburgh Steel Co.
REPUBLIC STEEL CORP.
Rockford Bolt & Steel Co.
St. Louis Screw & Bolt Co.
Sawyer Belt Hock & Wedge Co., Inc.
SHEFFIELD DIV. ARMCO STEEL CORP.
Star Expansion
Strong, Carlisle & Hammond Co.
TENNESSEE COAL & IRON DIV. U. S. STEEL CORP.
Torrington Co., Progressive Mfg. Co. Div.

299 FEEDERS, CHAIN (ROSS TYPE)

Denver Equipment Co.
DIESEL ENERGY CORP.
IOWA MFG. CO.
LINK-BELT CO.
ROSS SCREEN & FEEDER CO.

300 FEEDERS, CONSTANT WEIGHT & WEIGHING —also see Scales

ABCs Scale Div. McDowell Co., Inc.
B-I-F Industries, Inc.
Dwight-Lloyd Div. McDowell Co., Inc.
Erie Strayer Co.
HARDINGE CO., INC.
INDUSTRIAL PHYSICS & ELECTRONICS CO.
JEFFREY MFG. CO.
MERRICK SCALE MFG. CO.
LINK-BELT CO.
McDowell Co., Inc.
Patterson Foundry & Machine Co., Div Ferro Corp
PERMUTIT CO., DIV. PFAUDLER PERMUTIT INC.
Richardson Scale Co.
Schaffer Poidometer Co.
Stephens-Adamson Mfg. Co.

Syntron Co.
Toledo Scale, Div. Toledo Scale Corp.
Wellman Engineering Co. McDowell Enterprise

301 FEEDERS, REAGENT, DRY

ABCs Scale Div. McDowell Co., Inc.
B-I-F Industries, Inc.
Dagley Mfg. Co.
Denver Equipment Co.
Fisher & Porter Co.
LINK-BELT CO.
JEFFREY MFG. CO.
MERRICK SCALE MFG. CO.
Morse Bros. Machinery Co.
PERMUTIT CO., DIV. PFAUDLER PERMUTIT INC.
Savage Co., W. J.
Syntron Co.

302 FEEDERS, REAGENT, LIQUID

ABCs Scale Div. McDowell Co., Inc.
American Water Softener Co.
B-I-F Industries, Inc.
Brosites Products Corp.
Clarkson Co.
Dagley Mfg. Co.
Denver Equipment Co.
Fisher & Porter Co.
Galigher Co.
Graver Water Conditioning Co.
INFILCO, INC.
Manzel Div., Houdaille Industries, Inc.
MINE & SMELTER SUPPLY CO., MFG. DIV.
Minerals Engineering Co.
Morse Bros. Machinery Co.
PERMUTIT CO., DIV. PFAUDLER PERMUTIT INC.

303 FEEDERS RECIPROCATING PLUNGER

Acme Road Machinery Co., Inc.
Bartlett & Snow Co., C. O.
B-I-F Industries, Inc.
Bodinson Manufacturing Co., Inc.
Carrier Conveyor Corp.
Denver Equipment Co.
Gruendler Crusher & Pulverizer Co.
Hack Engineering Co.
Helmick Foundry-Machine Co.
HEWITT-ROBINS, INC.
Hills-McCanna Co.
Hirsch Bros. Machy. Co.
IOWA MFG. CO.
LINK-BELT CO.
Lippmann Engineering Works, Inc.
Manzel Div., Houdaille Industries, Inc.
MC NALLY PITTSBURG MFG. CORP.
McLANAHAN & STONE CORP.
Morse Bros. Machinery Co.
NATIONAL IRON CO.
Pioneer Engineering, Div. Poor & Co., Inc.
Rogers Iron Works Co.
STRAUB MFG. CO.
Telluride Iron Works Co.
Universal Dredge Mfg. Co.
Universal Road Machinery Co.

304 FEEDERS, REVOLVING DISK & PLATE

Allen-Sherman-Hoff Co.
Bartlett & Snow Co. C. O.
B-I-F Industries, Inc.
BIRDSBORO STEEL FOUNDRY & MACHINE CO.
Bodinson Manufacturing Co., Inc.
Bonded Scale & Machine Co.
Carpco Mfg., Co.
Chain Belt Co.
CONTINENTAL GIN CO. INDUSTRIAL DIV.
Dagley Mfg. Co.
DEISTER CONCENTRATOR CO.
Denver Equipment Co.
HARDINGE CO., INC.
HEWITT-ROBINS, INC.
Hirsch Bros. Machy. Co.
INFILCO, INC.
JEFFREY MFG. CO.
KENNEDY-VAN SAUN MFG. & ENG. CORP.
LINK-BELT CO.
Morse Bros. Machinery Co.
NATIONAL IRON CO.
Pulva Corp.
Pulverizing Machinery Div., Metals Disintegating Co., Inc.
Stephens-Adamson Mfg. Co.
STRAUB MFG. CO.
Telluride Iron Works Co.

305 FEEDERS, ROTARY, DRUM

DEISTER CONCENTRATOR CO.
Deister Machine Co.
Hack Engineering Co.
HARDINGE CO., INC.
Hirsch Bros. Machy. Co.
LINK-BELT CO.
Pulva Corp.
Pulverizing Machinery Div., Metals Disintegrating Co., Inc.
Specialty Engineering Co.
STRAUB MFG. CO.
Universal Dredge Mfg. Co.
WESTERN MACHINERY CO.

306 FEEDERS, ROTARY, VANE

ALLEN-SHERMAN-HOFF CO.
Bartlett & Snow Co., C. O.
B-I-F Industries, Inc.
CONTINENTAL GIN CO. INDUSTRIAL DIV.
Davis Foundry & Machine Works
Engineered Equipment Inc.
Erie Strayer Co.
Fuller Co., Subsidiary General American Transportation Corp.
HEWITT-ROBINS, INC.
Hirsch Bros. Machy. Co.
Holmes & Bros., Inc. Robert
LINK-BELT CO.
Patterson Foundry & Machine Co., Div., Ferro Corp.
Pulverizing Machinery Div,. Metals Disintegrating Co., Inc.
Pulva Corp.
Richardson Scale Co.
Specialty Engineering Co.
Stephens-Adamson Mfg. Co.
Wellman Engineering Co. McDowell Enterprise

307 FEEDERS, VIBRATING, SHAKING, ETC. (PLATE, TABLE, ETC.) — does not include Grizzlies or Screens

Acme Road Machinery Co., Inc.
Ajax Flexible Coupling Co.
Bacon-Greene & Milroy
BALDWIN-LIMA-HAMILTON CORP. CONSTRUCTION EQUIPMENT DIV.
BARBER-GREENE CO.
B-I-F Industries, Inc.
Branford Co.
Carpco Manufacturing, Inc.
Carrier Conveyor Corp.
Chain Belt Co.
CLEVELAND VIBRATOR CO.
Diamond Iron Works Div. Goodman Mfg. Co.
DRAVO CORP.
Erlez Mfg. Co.
Hack Engineering Co.
Hammermills, Inc.
HEWITT-ROBINS, INC.
Industrial Engr. & Construction Co.
IOWA MFG. CO.
JEFFREY MFG. CO.
JOY MFG. CO.
Kanawha Mfg. Co.
KENNEDY-VAN SAUN MFG. & ENG. CORP
Lecco Machinery & Engineering Co.
LINK-BELT CO.
Lippmann Engineering Works, Inc.
MINE & SMELTER SUPPLY CO.
NATIONAL IRON CO.
Overstrom & Sons, Inc.
Pioneer Engineering Div. Poor & Co. Inc
Prins & Associates, K.
Richardson Scale Co.
Ridge Equipment Co.
Roberts & Schaefer Co., Subsidiary of Thompson Starrett Co., Inc.
Rogers Iron Works Co.
Savage Co. W. J.
SIMPLICITY ENGINEERING CO.
Simplicity System Co.
Smith Engineering Works
Southwestern Engineering Co.
Specialty Engineering Co.
Stephens-Adamson Mfg. Co.
STRAUB MFG. CO.
Syntron Co.
TRAYLOR ENGINEERING MFG. CO.
Universal Dredge Mfg. Co.
Universal Engineering Corp.
Universal Road Machinery Co.

308 FENCING, METAL WIRE

American Chain & Cable Co., Inc., Page Steel & Wire Div.
AMERICAN STEEL & WIRE DIV. U. S. STEEL CORP.
BETHLEHEM STEEL CO., INC.
COLORADO FUEL & IRON CORP.
Copperweld Steel Co.
Dominion Steel & Coal Corp., Ltd.
JONES & LAUGHLIN STEEL CORP.
Pittsburgh Steel Co.
REPUBLIC STEEL CORP.
SHEFFIELD DIV. ARMCO STEEL CORP.
TENNESSEE COAL & IRON DIV. U. S. STEEL CORP.
U. S. STEEL CORP. COLUMBIA-GENEVA STEEL DIV.
WICKWIRE SPENCER STEEL DIV. COLORADO FUEL & IRON CORP.

309 FILTERS, AIR, GAS & DUST

AMERICAN AIR FILTER CO., INC.
Convair, Inc.
DUCON INC.
Fuller Co.
DIESEL ENERGY CORP.
GARDNER DENVER CO.
GOODYEAR TIRE & RUBBER CO. INDUSTRIAL PRODUCTS
GOODYEAR TIRE & RUBBER CO.
Hazemag USA Inc.
Koppers Co., Inc. Metal Prod. Div.
Leavitt Machine Co.
Lincoln Engineering Co. Div. McNeil Machine Engineering Co.
Mahon Co., R. C.
MINE SAFETY APPLIANCES Co.
NORTHERN BLOWER CO.
Pulmosan Safety Equipment Corp.
Purolator Products, Inc.
SLY MFG. CO., W. W.
Staplex Co. Air Sampler Div.
Uehling Instrument Co.
VICTOR EQUIPMENT CO. ALLOY ROD METAL DIV.
WESTERN PRECIPITATION CORP.
Westinghouse Air Brake Co. Inc. Products Div.
Wheelabrator Corp.
Whiting Corp.
Wilkerson Corp.
Winslow Engineering & Mfg. Co.

310 FILTERS, CONCENTRATE

Bird Machine Co.
Booth Co.
Carpco Mfg., Inc.
Dagley Mfg. Co.
Denver Equipment Co.
DORR-OLIVER, INC.
Duriron Co., Inc.
EIMCO CORP.
Filtration Engineers, Inc. Sub. of American Machine & Metals, Inc.
Galigher Co.
HARDINGE CO., INC.
LINK-BELT CO.
Morse Bros. Machinery Co.
Peterson Filters & Engr. Co.
Shriver & Co., T.

311 FILTERS, ENGINE OIL, ETC.

Buffalo Hammer Mill Corp.
Frantz Co., Inc., S. G.
Marvel Engineering Co.
Newark Wire Cloth Co.
Purolator Products, Inc.
Schroeder Brothers Corp.
Shriver & Co., T.
U. S. Hoffman Machinery Corp Air Appliance Div.
Winslow Engineering & Mfg. Co.

312 FILTERS, WATER & LIQUID

American Water Softener Co.
Arrow Tank Co. Inc.
Atlantic Tank Corp.
Bethlehem Pacific Coast Steel Corp.
B-I-F Industries, Inc.
Bird Machine Co.
Brosites Products Corp.
Buffalo Hammer Mill Corp.
Chicago Bridge & Iron Co.
Cochrane Corp.
Condenser Service & Engineering Co.
Corning Glass Works
DORR-OLIVER, INC.
Duriron Co., Inc.
EIMCO CORP.
Filtration Engineers, Inc. Sub of American Machine & Metals, Inc.
Graver Water Conditioning Co.
HARDINGE CO., INC.
INFILCO, INC.
MINE & SMELTER SUPPLY CO., MFG. DIV.
Marvel Engineering Co.
Newark Wire Cloth Co.
Peterson Filters & Engr. Co.
PERMUTIT CO., DIV. PFAUDLER PERMUTIT INC.
Plumbing Products Div., Zurn Industries, Inc.
Purolator Products Inc.
Schroeder Brothers Corp.
Shriver & Co., T.
U. S. Hoffman Machinery Corp. Air Appliance Div.
Winslow Engineering & Mfg. Co.

313 FILTER BAGS

Albany Felt Co.
BEMIS BRO. BAG CO.
Brosites Products Corp.
Dagley Mfg. Co.
Daniels, Inc., C. R.
DUCON, INC.
EIMCO CORP.
Filtration Engineers, Inc. Sub. of American Machine & Metals Inc.
Flocker & Co., John
Koppers Co., Inc. Metal Prod. div.
NATIONAL FILTER MEDIA CORP.
NORTHERN BLOWER CO.
Pendleton Woolen Mills
Peterson Filters & Engr. Co.
Safety Clothing & Equipment Co.
Shriver & Co., T.
SLY MFG. CO., W. W.
Stanley Co. Inc., William W.
Wheelabrator Corp

314 FILTER CLOTH

Albany Felt Co.
Brosites Products Corp.
Buffalo Wire Works Co.
Cambridge Wire Cloth Co.
COLORADO FUEL & IRON CORP.
Dagley Mfg. Co.
Daniels, Inc., C. R.
EIMCO CORP.
Filtration Engineers, Inc. Sub. of American Machine & Metals, Inc.
House & Sons, Inc. Chas. W.
Ludlow-Saylor Wire Cloth Co.
Multi-Metal Wire Cloth Co., Inc.
NATIONAL FILER MEDIA CORP.
Newark Wire Cloth Co.
Pendleton Woolen Mills
Peterson Filters & Engr. Co.
Shriver & Co., T.
SLY MFG CO., W. W.
Stanley Co, Inc., William W.
TYLER CO., W. S.
U S. RUBBER CO.
Wellington Sear Co.
WICKWIRE SPENCER STEEL DIV. COLORADO FUEL & IRON CORP.
Wilkerson Corp.

315 FILTER MEDIA (OTHER THAN BAGS & CLOTH)

AMERICAN AIR FILTER CO., INC.
American Water Softener Co.
Brosites Products Corp.
Condenser Service & Engineering Co.
DuPont De Nemours & Co., Inc. E. I. Fabrics Div.
Duriron Co., Inc.
Eagle-Picher Co.
EIMCO CORP.
Filtration Engineers, Inc., Sub. of American Machine & Metals, Inc.
Graver Water Conditioning Co.
Johns-Manville
Koppers Co., Inc. Metal Prod. Div.
Marvel Engineering Co.
MINE SAFETY APPLIANCES CO.
Multi-Metal Wire Cloth Co., Inc.
NATIONAL FILTER MEDIA CORP.
Norton Co.
PERMUTIT CO., DIV. PFAUDLER PERMUTIT INC.
Peterson Filters & Engr. Co.
Pettinos, Inc., George F.
Shriver & Co., T.

316 FIRE FIGHTING EQUIPMENT & SUPPLIES

Acme Rubber Mfg. Co.
Bullard Co., E. D.
Daniels, Inc., C. R
DuPont de Nemours & Co., Inc., E. I.
Eastman-Pacific Co.
Elkhart Brass Mfg. Co., Inc.
Falcon Alarm Co., Inc.
Four Wheel Drive Auto Co.
Fyr-Fyter Co.
Gatke Corp.
Goodall Rubber Co.
GOODRICH INDUSTRIAL PRODUCTS CO., B. F.
Grinnell Co., Inc.
HAMILTON RUBBER MFG. CORP.
HEWITT-ROBINS, INC.
Kidde & Co., Inc., Walter
Pickard Industries, Inc.
Porto Pump Inc.
Pulmosan Safety Equipment Corp.
H. K. PORTER COMPANY, THERMOID DIV.
Scott Aviation Corp.
Snyder & Son, Inc., M. L.
Stop-Fire, Inc.
U. S. RUBBER CO.

317 FIRST AID EQUIPMENT & SUPPLIES

Bullard Co., E. D.

MINE SAFETY APPLIANCES CO.
NATIONAL MINE SERVICE CO.
Pulmosan Safety Equipment Corp.
Safety Clothing & Equipment Co.
Scott Aviation Corp.

317A FLOCCULATING AGENTS

AMERICAN CYANAMID CO.
Burtonite Co.
DOW CHEMICAL CO.
GOODRICH INDUSTRIAL PRODUCTS CO., B. F.
Monsanto Chemical Co.
Stein, Hall & Co., Inc.

318 FLOOD LIGHTS, CARBIDE

Linde Co. Union Carbide Corp.

319 FLOOD LIGHTS, ELECTRIC—also see Lighting Fixtures & Lamps

Appleton Electric Co.
Crouse Hinds Co.
GENERAL ELECTRIC CO., APPARATUS SALES DIV.
Guyan Machinery Co.
JOY MFG. CO.
Line Material Industries McGraw-Edison Co.
MINE SAFETY APPLIANCES CO.
Multi Electrical Mfg. Co.
Phoenix Products Co.
Pittsburgh Reflector Co.
Pyle-National Co.
Steber Mfg. Co.
WESTINGHOUSE ELECTRIC CORP.

320 FLOTATION MACHINES

Booth Co.
Canadian Locomotive Co., Ltd.
Cannon Concentrator Co.
Chain Belt Co.
Denver Equipment Co.
DIESEL ENERGY CORP.
Galigher Co.
Graver Water Conditioning Co.
INFILCO, INC.
MACHINERY CENTER, INC.
Morse Bros. Machinery Co.
National Tank & Pipe Co.
STEARNS ROGER MFG. CO.
TURBO-MIXER DIV., GENERAL AMERICAN TRANSPORTATION CORP.
U. S. Hoffman Machinery Corp.
WEMCO, DIV. WESTERN MACHINERY CO.

321 FLOTATION REAGENTS

AMERICAN CYANAMID CO.
ARMOUR CHEMICAL DIV.
Baker Chemical Co., J. T.
BAKER & ADAMSON PRODUCTS, GENERAL CHEMICAL DIV., ALLIED CHEMICAL CORP.
Canadian Industries Ltd.
Dewey & Almy Chemical Co., Div. W. R. Grace & Co.
DOW CHEMICAL CO.
DuPont de Nemours & Co., E. I.
Emery Industries, Inc.
Farbwerke Hoechst, A. G.
Food Machinery & Chemical Corp., Westvaco Chlor-Alkali Div.
General Mills, Inc.
HERCULES POWDER CO.
Heyden Newport Chemical Corp.
Marathon Corp., Chemical Sales Dept. Div. American Can. Co.
Michigan Chemical Corp.
Oronite Chemical Co.
Pacific Lumber Co.
Pennsalt Chemicals Corp.
PHELPS DODGE REFINING CORP.
PHILADELPHIA QUARTZ CO.
Reilly Tar & Chemical Corp.
STANDARD OIL CO. OF CALIF., WESTERN OPERATIONS, INC.
Stein, Hall & Co., Inc.
Tennessee Corp.
Union Carbide Chemicals Co. Union Carbide Corp.
WEST END CHEMICAL CO.

322 FOOD, PACKAGED KITS

Bolton Farm Packing Co., Inc.

323 FORGES, BLACKSMITH, ETC.

Calumet Div. Calumet & Hecla, Inc.
Spang & Co.
Stardrill-Keystone Co.

324 FORGINGS, DROP, ETAL

Alco Products, Inc.
Allegheny Ludlum Steel Corp.
Aluminum Co. of America
AMERICAN BRAKE SHOE CO.
American Car & Foundry Div. ACF Industries, Inc.
American Forge Co.
American Tractor Equipment Corp.
Atlas Steels, Ltd.
Bethlehem Pacific Coast Steel Co.
Canton Forge, Div Poor & Co.
Carpenter Steel Co.
Columbus Forge & Iron Co.
Conley Frog & Switch Co.
CRUCIBLE STEEL CO. OF AMERICA
Dominion Steel & Coal Corp., Ltd.
Dresser Mfg. Div., Dresser Industries, Inc.
Duff Norton Co.
Duquesne Mine Supply Co.
Eaton Manufacturing Co.
Electric Materials Co.
Endicott Forging & Mfg. Co.
Giant Grip Mfg. Co.
Hayes Steel Products, Ltd.
Interstate Drop Forge Co.
Jessop Steel Co.
Ladish Co.
Moore Drop Forging Co.
Mueller Brass Co.
NATIONAL SUPPLY CO.
New Departure Div., General Motors Corp.
Ohio Forge & Machine Corp.
Pettibone Mulliken Corp.
Revere Copper & Brass, Inc.
Rockwell Spring & Axle Co. Timken-Detroit Axle Div.
Ryerson & Son, Inc., Joseph T.
Skookum Co., Inc.
Stackpole Carbon Co.
TENNESSEE COAL & IRON DIV. U. S. STEEL CORP.
Titan Metal Mfg. Co.
Tube Turns Div., Chemetron Corp.
Webb Co., Jervis B.

325 FREEZEPROOFING MATERIALS—does not include Concrete Additives

International Salt Co.
Morton Salt Co.
Stackpole Carbon Co.
U. S. Rubber Co.
Wyandotte Chemicals Corp.

326 FURNACES, INDUSTRIAL PROCESS, COMBUSTION HEATED (HEATING, MELTING, ROASTING, SMELTING, CERAMIC, METALLURGICAL, REFRACTORY, ETC.) — does not include: Boilers; Burners; Dryers; Heaters; Laboratory Equipment; Retorts; Sintering Equipment; also see below and: Kilns, Converters

Blue M Electric Co.
Denver Fire Clay Co.
DIESEL ENERGY CORP.
Engelhard Industries, Inc.
Hevi-Duty Electric Co.
Leeds & Northrup Co.
MINE & SMELTER SUPPLY CO., MANUFACTURING DIV.
Rockwell Co., W. S.
TREADWELL CO., M. H.
U. S. Smelting Furnace Co.
Whiting Corp.

327 FURNACES, INDUSTRIAL PROCESS, ELECTRIC HEATED (HEATING, MELTING, ROASTING, SMELTING, CERAMIC, METALLURGICAL, REFRACTORY, ETC.) — does not include: Boilers; Burners; Dryers; Heaters; Laboratory Equipment Retorts; Sintering Equipment; also see below and: Kilns, Converters

AMERICAN BRIDGE DIV., U. S. STEEL CORP.
ASEA ELECTRIC INC.
Blue M Electric Co.
ELEKTROKEMISK A. S.
Engelhard Industries, Inc.
GENERAL ELECTRIC CO., APPARATUS SALES DIV.
Harper Electric Furnace Corp.
Hevi-Duty Electric Co.
LECTROMELT FURNACE DIV. McGRAW EDISON CO.

328 FURNACES, INDUSTRIAL PROCESS, FLUIDIZED SOLIDS

DIESEL ENERGY CORP.
DORR-OLIVER, INC.
GENERAL ELECTRIC CO. APPARATUS SALES DIV.

329 FURNACES, INDUSTRIAL PROCESS, SHAFT (BLAST CUPOLA, ETC.)

Blue M Electric Co.
DIESEL ENERGY CORP.
Denver Fire Clay Co.
MINE & SMELTER SUPPLY CO., MFG. DIV.
MACE CO.
Pollock Co., William B.
TREADWELL CO., M. H.
Whiting Corp.

330 FURNACES, SHOP & BENCH (HEAT TREATING, MELTING, FORGING, ETC.) — also see: Drill (Rock) Bit & Steel Forging & Heat Treating Furnaces; Forges; does not include Laboratory Equipment

Bigelow-Liptak Corp.
Blue M Electric Co.
Denver Fire Clay Co.
Hevi-Duty Electric Co.
GENERAL ELECTRIC CO. APPARATUS SALES DIV.
Leeds & Northrup Co.
Rockwell Co., W. S.

331 FURNACES, SMELTING AND ROASTING

ALLIS-CHALMERS MFG. CO.
Bethlehem Foundry & Machine
Bigelow Liptak
COLORADO IRON WORKS CO., SUBSIDIARY OF MINE & SMELTER SUPPLY CO.
DORR-OLIVER, INC.
ELEKTROKEMISK, A. S.
GOULD, GORDON I.
LECTROMELT FURNACE CO. DIV. McGRAW ELECTRIC CO.
MACE CO.
MINE & SMELTER SUPPLY CO., MFG. DIV.
NICHOLS ENGINEERING & RESEARCH
Pacific Foundry Co. Ltd.
Salem-Brosius, Inc.
Stearns-Roger Mfg. Co.
TREADWELL CO., M. H.
U. S. Smelting Furnace Co.
Whiting Corp.

(FURNACE BURNERS—see Burners)

332 FURNACE CHARGERS

TREADWELL CO., M. H.
Whiting Corp.

333 FURNACE LININGS, WALL & ARCHES—also see Refractories

BABCOCK & WILCOX CO.
Bigelow-Liptak Corp.
Corhart Refractories
Denver Fire Clay Co.
Electro Refractories & Abrasives Corp.
General Refractories, Co.
Gladding McBean & Co.
Green Fire Brick Co., A. P.
Ironton Fire Brick Co.
Kaiser Aluminum & Chemical Sales, Inc.
Johns-Manville
Mexico Refractories Co.
North American Refractories Co.
Norton Co.
Pettinos, Inc. George F.
H. K. PORTER COMPANY INC., REFRACTORIES DIV.
Quigley Co., Inc.
Refractory & Insulation Corp.
Reintjes Co., George P.
Robinson Clay Product Co.
STEARNS ROGER MFG. CO.

G

(GAGES—see Meters)

(GALVANOMETERS — see Meters, Electricity)

334 GASES, INDUSTRIAL (OXYGEN, HYDROGEN, CARBON DIOXIDE, ACETYLENE, ETC.)

Air Reduction Sales Co., Div. Air Reduction Co., Inc.
Linde Co., Union Carbide Corp.
National Cylinder Gas
Sun Oil Co.

335 GAS (& HUMIDITY) DETECTORS & INDICATORS—also see Meters, Chemical

American Instrument Co., Inc.
Brabender Corp.
Bristol Co.
Central Scientific Co.
Charles Engelhard, Inc.
Consolidated Electrodynamics Corp.
CURTISS-WRIGHT CORP. ELECTRONICS DIV.
Fisher & Porter Co.
GENERAL ELECTRIC CO. APPARATUS SALES DIV.
Linde Co., Union Carbide Corp.
MINE SAFETY APPLIANCES CO.
NATIONAL MINE SERVICE CO.
PERMUTIT CO., DIV. PFAUDLER
Taller & Cooper, Inc.
WESTINGHOUSE ELECTRIC CORP.

336 GAS GENERATORS

Air Reduction Sales Co., Div. Air Reduction Co., Inc.
Charles Engelhard, Inc.
GENERAL ELECTRIC CO. APPARATUS SALES DIV.
Hevi-Duty Electric Co.
Industrial Air Products Co.
Linde Co. Union Carbide Corp.
National Cylinder Gas
Philips Electronics, Inc., Instruments Div.
Sight Feed Generator Co.

337 GAS SEPARATION PROCESS EQUIPMENT (SPECIAL)—does not include Dust Collectors or standard auxiliary equipment

Black, Sivalls & Bryson, Inc.
Charles Engelhard, Inc.
Graver Tank & Mfg. Co., Div. Union Tank Car Co.
Process Engineering, Inc.
Standard Steel Corp.

338 GASKETS

Belmont Packing & Rubber Co.
Belmont Smelting & Refining Works, Inc.
Carey Mfg. Co., Philip
Carlyle Rubber Co.
Chase Brass & Copper Co.
Continental-Diamond Fibre Corp., Subsidiary Budd Co.
Continental Rubber Works
Felt Products Mfg. Co.
Garlock Packing Co.
Gatke Corp.
Goodall Rubber Co.
GOODRICH INDUSTRIAL PRODUCTS CO., B. F.
GOODYEAR TIRE & RUBBER CO. INDUSTRIAL PRODUCTS
GOODYEAR TIRE & RUBBER CO.
Greene, Tweed & Co.
Hales Co., W. M.
Hayes Steel Products, Ltd.
HEWITT-ROBINS, INC.
Houghton & Co., E. F.
Johns-Manville
Metallo Gasket Co.
National Vulcanized Fibre Co.
New York Belting & Packing Co.

H. K. PORTER COMPANY, INC., THERMOID DIV.
RAYBESTOS-MANHATTAN, INC. MANHATTAN RUBBER DIV.
Synder & Son, Inc., M. L.
U. S. RUBBER CO.

339 GEAR MOTORS — Also see: Drives; Electric Motors

ALLIS-CHALMERS MFG CO.
Allis Co., Louis
Brown, Inc., David
Century Electric Co.
Christian Engineers, J. D.
Cone-Drive Gears Div. Michigan Tool Co.
Diehl Mfg. Co.
Electro Dynamic Div., General Dynamics Corp.
Elliott Co.
FAIRBANKS, MORSE & CO.
FALK CORP.
Foote Bros. Gear & Machine Corp.
GENERAL ELECTRIC CO. APPARATUS SALES DIV.
HEWITT-ROBINS, INC.
Howell Electric Motors Co.
Imperial Electric Co.
LINK-BELT CO.
Marble Card Electric Corp.
Master Electric Co.
Morse Chain Co., Div. Borg-Warner Industries
Northwestern Electric Co.
Ohio Gear Co.
PHILADELPHIA GEAR CORP.
Reliance Electric & Engineering Co.
Sterling Electric Motors, Inc.
U. S. Electrical Motors, Inc.
Wagner Electric Corp.
Western Gear Corp.
WESTINGHOUSE ELECTRIC CORP.

(GEAR PULLERS — see Car Wheel & Gear Pullers)

340 GEARS & PINIONS, METAL—also see below

Acme Road Machinery Co., Inc.
AMERICAN BRAKE SHOE CO. AMERICAN MANGANESE STEEL DIV.
Ampco Metal, Inc.
Brad Foote Gear Works, Pittsburgh
Brown, Inc., David
Chistian Engineers, J. D.
CLARK EQUIPMENT CO. TRANSMISSION DIV.
Cone-Drive Gears Div., Michigan Tool Co.
CRUCIBLE STEEL CO. OF AMERICA
Cullman Wheel Co.
Davis Foundry & Machine Works
Eaton Mfg. Co.
FALK CORP.
Farrel-Birmingham Co., Inc.
Farrell-Cheek Steel Co.
Flood City Brass & Electric Co.
Foote Bros. Gear & Machine Corp.
Frog, Switch & Mfg. Co.
Fuller Manufacturing Co.
GENERAL ELECTRIC CO. GEAR MOTOR & TRANSMISSION COMPONENTS DEPT.
HEWITT-ROBINS, INC.
Hirsch Bros. Machy Co.
JEFFREY MFG. CO.
Kanawha Mfg. Co.
Kensington Steel Div., Poor & Co.
LINK-BELT CO.
Marathon Coal Bit Co., Inc.
Massachusetts Gear & Tool Co., Div., Geartronics Corp.
McNALLY PITTSBURG MFG. CORP.
Ogden Iron Works
Ohio Gear Co.
Olds Alloy Co.
Penn Machine Co.
Perkins Machine & Gear Co.
PHILADELPHIA GEAR CORP.
PITTSBURGH GEAR CO.
Rockwell Spring & Axle Co. Timken-Detroit Axle Div.
Specialty Engineering Co.
Stahl Gear & Machine Co.
STEARNS ROGER MFG. CO.
Stroh Process Steel Co.
Tool Steel Gear & Pinion Co.
Vulcan Iron Works
West Virginia Armature Co.
Western Gear Corp.
WESTINGHOUSE ELECTRIC CORP.
Whitney Chain Co.

341 GEARS & PINIONS, METAL LARGE (BALL-MILL, MINE-SHAFT HOIST, ET AL)

Alco Products, Inc.
Ampco Metal, Inc.
BIRDSBORO STEEL FOUNDRY & MACHINE CO.
Brad Foote Gear Works Pittsburgh Gear Co. Div.
Brown, Inc., David
Cone-Drive Gears Div., Michigan Tool Co.
CRUCIBLE STEEL CO. OF AMERICA
Davis Foundry & Machine Works
DeLaval Steam Turbine Co.
Dominion Steel & Coal Corp., Ltd.
FALK CORP.
Farrel-Birmingham Co., Inc.
Farrell-Cheek Steel Co.
Foote Bros. Gear & Machine Corp.
Frog, Switch & Mfg. Co.
HEWITT-ROBINS, INC.
Hirsch Bros. Machy. Co.
Kanawha Mfg. Co.
LINK-BELT CO.
Ohio Gear Co.
Olds, Alloy Co.
PHILADELPHIA GEAR CORP.
PITTSBURGH GEAR CO.
Sorel Steel Foundries, Ltd.
Stahl Gear & Machine Co.
STEARNS ROGER MFG. CO.
Stroh Process Steel Co.
Tool Steel Gear & Pinion Co.
Vulcan Iron Works
West Virginia Armature Co.
Western Gear Corp.
WESTINGHOUSE ELECTRIC CORP.

342 GEARS & PINIONS, NON-METALLIC

Brad Foote Gear Works Pittsburgh Gear Co. Div.
Continental-Diamond Fibre Corp. A Subsidiary of Budd Co.
Flood City Brass & Electric Co.
Foote Bros. Gear & Machine Corp.
Gatke Corp.
HEWITT-ROBINS, INC.
Hirsch Bros. Machy. Co.
Massachusetts Gear & Tool Corp., Div. Geartronics Corp.
Menlo Research Laboratory
National Vulcanized Fibre Co.
Ohio Gear Co.
Perkins Machine & Gear Co.
PHILADELPHIA GEAR WORKS
PITTSBURGH GEAR CO.
Stahl Gear & Machine Co.
Synthane Corp.
West Virginia Armature Co.
Western Gear Corp.
WESTINGHOUSE ELECTRIC CORP.

(GEIGER COUNTERS — see Radiation Detectors)

343 GEOLOGIST'S EQUIPMENT (PICKS, POUCHES, ETC.)—does not include: Surveying Instruments; Drafting Equipment; Geophysical instruments; Food: Packaged Kits; Laboratory Equip.

Cleco Div., Reed Roller Bit Co.
Collins Co.
Geophysical Instrument & Supply Co.
Gibraltar Equipment & Mfg. Co.
Stanley Tool Co.
Stratex Instrument Co.

344 GEOPHYSICAL INSTRUMENTS—does not include: Radiation Detectors; Ultra-Violet Lights

American Paulin System
BALL BROTHERS RESEARCH CORP.
Detectron Corp.
Engineers Syndicate, Ltd.
Failing Co., George E.
Fisher Research Laboratory Inc.
Geo-Optic & Paper Corp.
Geophysical Instrument & Supply Co.
Geophysical Specialties Co.
Goldak Co., Inc.
Houston Technical Laboratories
Jarrell-Ash Co.
McPhar Geophysics, Ltd.
McPhar Manufacturing, Ltd.
Philips Electronics, Inc., Instrument Div.
Selscor Manufacturing Co.
Seismograph Service Corp.
Southwestern Industrial Electronics Co.
Spartan Air Services
Sprengnether Instrument Co., Inc., W. F.
Texas Instruments, Inc. Industrial Instrumentation Div.
Universal Atomics Div. Universal Transistor Products Corp.
Ultra-Violet Products, Inc.
VARIAN ASSOCIATES

345 GRADERS, ROAD, TOWED & SELF-PROPELLED

ALLIS CHALMERS MFG. CO.
AUSTIN-WESTERN CONSTRUCTION EQUIPMENT DIV. BALDWIN-LIMA-HAMILTON CORP.
CATERPILLAR TRACTOR CO.
Galion Iron Works
HUBER-WARCO CO.
LE TOURNEAU-WESTINGHOUSE CO.
Pettibone Mulliken Corp.
Westinghouse Air Brake Co.

346 GRATINGS, FLOOR

Bates Co., Walter
BLAW-KNOX CO.
Borden Metal Products Co.
DRAVO CORP.
HENDRICK MFG. CO.
Irving Subway Grating Co., Inc.
Kerrigan Iron Works
Klemp Metal Grating Corp.
Laubenstein Mfg. Co.
Ryerson & Son, Inc., Joseph T.

(GRINDERS & BUFFERS—see below; also see: Drill (Rock) Bit & Steel Grinders)

347 GRINDERS & BUFFERS, ELECTRIC

Baldor Electric Co.
Bitco, Inc.
Black & Decker Mfg. Co.
Blount Co., J. G.
CHICAGO PNEUMATIC TOOL CO.
Cininnati Electrical Tool Co.
Fisher Scientific Co.
Hisey-Wolf Machine Co.
INGERSOLL-RAND CO.
Lippmann Engineering Works, Inc.
Milwaukee Electric Tool Corp.
Remington Arms Co., Inc.
Rockwell Mfg. Co., Delta Power Tool Div.
Ryerson & Son, Inc., Joseph T.
Standard Electrical Tool Co.
Stanley Electric Tools Div. Stanley Works
Thor Power Tool Co.
U. S. Electrical Tool Co.

348 GRINDERS & BUFFERS, PNEUMATIC

ATLAS COPCO PACIFIC, INC.
Bitco, Inc.
CHICAGO PNEUMATIC TOOL CO.
GARDNER DENVER CO.
Holman Bros.—Canada Ltd.
INGERSOLL-RAND CO.
Reed Roller Bit Co.
Remington Arms Co., Inc.
STOODY CO.
Thor Power Tool Co.

349 GRINDING (& CUTTING) WHEELS

American Emery Wheel Works
American Coldset Corp.
ATLAS COPCO PACIFIC, INC.
Bay State Abrasive Products Co.
Chicago Wheel & Mfg. Co.
Electro Refractories & Abrasives Corp.
GARDNER DENVER CO.
Macklin Co.
Norton Co.
Peninsular Grinding Wheel Div.
Precision Grinding Wheel Co., Inc.
RAYBESTOS-MANHATTAN, INC. MANHATTAN RUBBER DIV.
Ryerson & Son, Inc., Joseph T.
Simonds Worden White Co.
Sterling Grinding Wheel Co.
Thor Power Tool Co.
U. S. RUBBER CO. MECHANICAL GOODS DIV.
Waltham Grinding Wheel Co.

350 GRIZZLIES, FEEDING & MOVING

Acme Road Machinery Co., Inc.
Davis Foundry & Machine Works
Hammermills, Inc.
HEWITT-ROBINS, INC.
Heyl & Patterson, Inc.
IOWA MFG. CO.
JEFFREY MFG. CO.
KENNEDY-VAN SAUN MFG. & ENG. CORP.
LINK-BELT CO.
MC LANAHAN & STONE CORP.
NATIONAL MALLEABLE & STEEL CASTINGS CO.
NORDBERG MFG. CO.
Rogers Iron Works Co.
ROSS SCREEN & FEEDER CO.
SIMPLICITY ENGINEERING CO.
Smith Engineering Works
Stephens-Adamson Mfg. Co.
STRAUB MFG. CO.
Syntron Co.
Telluride Iron Works Co.
TRAYLOR ENGINEERING & MFG. CO.
TYLER CO., W. S.
Universal Engineering Corp.
Washington Machinery Co.

351 GRIZZLIES, STATIONARY

Acme Road Machinery Co., Inc.
AMERICAN BRAKE SHOE CO. AMERICAN MANAGANESE STEEL DIV.
BALDWIN-LIMA-HAMILTON CORP. CONSTRUCTION EQUIPMENT DIVN
Bodinson Manufacturing Co., Inc.
CARD IRON WORKS, C. S.
COLORADO FUEL & IRON CORP.
Columbia Steel Casting Co., Inc.
Davis Foundry & Machine Works
Diamond Iron Works Div. Goodman Mfg. Co.
Hammermills, Inc.
HENDRICK MFG. CO.
HEWITT-ROBINS, INC.
Hirsch Bros. Machy. Co.
JEFFREY MFG. CO.
KENNEDY-VAN SAUN MFG. & ENG. CORP.
Kenyon Walker Machinery Co.
LINK-BELT CO.
Lippmann Engineering Works, Inc.
Morse Bros. Machinery Co.
NATIONAL MALLEABLE & STEEL CASTINGS CO.
Ogden Iron Works
Pioneer Engineering Div. Poor & Co. Inc.
Smith Engineering Works
Stephens-Adamson Mfg. Co.
STRAUB MFG. CO.
Telluride Iron Works Co.
TRAYLOR ENGINEERING & MFG. CO.
TYLER CO., W. S.
Universal Engineering Corp.
Universal Road Machinery Co.
Washington Machinery Co.
YUBA CONSOLIDATED INDUSTRIES, INC., YUBA MINING DIV.

(GROUT PUMPS — see Concrete; Pumps)

H

352 HARDFACING ALLOYS & RODS—also see: Metallizing; Welding

Air Reduction Sales Co., Div. Air Reduction Co., Inc.
All-State Welding Alloys Co., Inc.
ALLOY RODS CO.
AMERICAN BRAKE SHOE CO. AMERICAN MANGANESE STEEL DIV.
American Chain & Cable Co., Inc. Page Steel & Wire Div.
Ampco Metal, Inc.
Coast Metals, Inc.
CRUCIBLE STEEL CO. OF AMERICA
Eutectic Welding Alloys Corp.
Hales Co., W. M.
Hard-N-Tuff Corp.
Haynes Stellite Co. Div. Union Carbide Corp.
Hobart Bros. Co.
Industrial Air Products Co.
Industrial Overlay Metals, Inc.
INTERNATIONAL NICKEL CO.
Kennametal Inc. Mining Tool Div.
Lincoln Electric Co.
Marquette Mfg. Co., Inc.
Metal & Thermit Corp.
Metallizing Engineering Co., Inc.
Minerals Engineering Co.
National Cylinder Gas
Norton Co.
Rankin Manufacturing Co.
Resisto-Loy Co., Inc.
Shwayder Chemical Metallurgy Corp.
Sight Feed Generator Co.
STOODY CO.
Stulz-Sickles Co.
VICTOR EQUIPMENT CO. ALLOY ROD & METAL DIV.

(HEATERS—see below;

(also see: Boilers; Dryers; Furnaces; Kilns; Retorts; Screen Heaters, Burners)

353 HEATERS, PROCESS, AIR & GAS (PRE-HEATERS, RECUPERATORS, REGENERATORS, ETC.)

American Standard Industrial Div.
BABCOCK & WILCOX CO.
Bigelow-Liptak Corp.
Carbone Corp.
Fuller Co.
KENNEDY-VAN SAUN MFG. & ENG. CORP.
Salem-Brosius, Inc.
WESTINGHOUSE ELECTRIC CORP.

354 HEATERS, SPACE—does not include: Boilers; Furnaces; Kilns; or Burners alone

Acme Electric Heating Co.
AMERICAN AIR FILTER CO., INC.
American Standard Industrial Div.
Buffalo Forge Co.
Carrier Corp.
Clarage Fan Co.
Daniels, Inc., C. R.
DRAVO CORP.
Engelhard Industries, Inc.
GENERAL ELECTRIC CO. APPARATUS SALES DIV.
GRINNELL CO., INC.
Guyan Machy. Co.
ILG Electric Ventilating Co.
Indiana Foundry Co.
MINE & SMELTER SUPPLY CO.
Vulcan Electric Co.
WESTINGHOUSE ELECTRIC CORP. STURTEVANT DIV.
Wing Mfg. Co., L. J.

355 HEAT EXCHANGERS—also see: Boilers; Heaters; Coolers

Alco Products, Inc.
American-Standard Industrial Div.
BABCOCK & WILCOX
Canadian Locomotive Co., Ltd.
Carbone Corp.
Christian Engineers, J. D.
Cochrane Corp.
Condenser Service & Engineering Co.
Duriron Co., Inc.
MINE & SMELTER SUPPLY CO.
National Carbon Co., Div. Union Carbide Corp.
Pacific Coast Engineering Co.
Southwestern Engineering Co.
Standard Steel Corp.
WESTINGHOUSE ELECTRIC CORP.
YUBA CONSOLIDATED INDUSTRIES, INC.

(HEAVY MEDIA SEPARATORS—see Separators, Heavy Media)

(HOISTS — see below; refer to Winches for type of power; also see: Cranes)

356 HOISTS, DREDGE, CRANE & SHOVEL TYPES

AMERICAN HOIST & DERRICK CO.
AUSTIN-WESTERN CONSTRUCTION EQUIPMENT DIV. BALDWIN-LIMA-HAMILTON CORP.
BALDWIN - LIMA - HAMILTON CORP., LIMA WORKS, CONSTRUCTION EQUIPMENT DIV.
Clyde Iron Works, Inc.
Eagle Iron Works
HARNISCHFEGER CORP.
HEWITT-ROBINS, INC.
Hyster Co.
Koehring Co.
Lidgerwood Industries, Inc.
Link-Belt Speeder Corp.
MANITOWOC ENGINEERING CORP.
MARION POWER SHOVEL CO.
McKiernan-Terry Corp., Mead Morrison Div.
Pacific Coast Engineering Co.
Reading Crane & Hoist Corp.
Rockwell Spring & Axle Co. Timken-Detroit Axle Div.
Superior-Lidgerwood-Mundy Corp.
Washington Iron Works
Wiley Mfg. Co.
YUBA CONSOLIDATED INDUSTRIES, INC.

357 HOISTS, DRAGLINE SCRAPER-SLUSHER

AMERICAN HOIST & DERRICK CO.
GARDNER-DENVER CO.
HEWITT-ROBINS, INC.
INGERSOLL-RAND CO.
JOY MFG. CO.
Koehring Co.
Lidgerwood Industries, Inc.
MARION POWER SHOVEL CO.
O. K. Machinery Div. John C. Motter Printing Press Co.
Rockwell Spring & Axle Co. Timken-Detroit Axle Div.
SAUERMAN BROS., INC.
VULCAN IRONWORKS CO., (DENVER)

358 HOISTS, LIFT, HAND CHAIN & RATCHET

American Chain & Cable Co., Inc. Wright Hoist Div.
Chisholm-Moore Hoist Div. Columbus McKinnon Chain Corp.
Chester Hoist Div. National Screw Mfg. Co.
Conco Engineering Works
Coffing Hoist Div. Duff-Norton Co.
Denver Equipment Co.
Duff Norton Co.
Forker Corp.
GARDNER-DENVER CO.
Graybar Elec. Co., Inc.
Hales Co., W. M.
Harrington Co
Manning, Maxwell & Moore, Inc.
Manning, Maxwell & Moore, Inc. Shaw Box Crane & Hoist Div.
Reading Crane & Hoist Corp.
Robbins & Meyers, Inc., Hoist & Crane Div.
Round & Son, Inc., David
Ryerson & Son, Inc., Joseph T.
Yale & Towne Mfg. Co. Yale Materials Handling Div.

359 HOISTS, LIFT, SHOP TYPE PORTABLE & MOVABLE—does not include Hoists, Lift, Hand Chain

American Chain & Cable Co., Inc. Wright Hoist Div.
AMERICAN PULLEY CO.
ATLAS COPCO PACIFIC, INC.
Chester Hoist Div., National Screw Mfg. Co.
CHICAGO PNEUMATIC TOOL CO.
Clyde Iron Works, Inc.
Coffing Hoist Div. Duff-Norton Co.
Conco Engineering Works
Construction Machy. Co.
Denver Equipment Co.
Detroit Hoist & Machine Co.
Duff-Norton Co.
Electro Lift, Inc.
Forker Corp.
GARDNER-DENVER CO.
Gripholst, Inc.
Harrington Co.
HEWITT-ROBINS, INC.
Hyster Co.
INGERSOLL-RAND CO.
JOY MFG. CO.
Lidgerwood Industries, Inc.
Louden Machinery Co.
Manning, Maxwell & Moore, Inc. Shaw Box Crane & Hoist Div.
O. K. Machinery Div. John C. Motter Printing Press Co.
Princeton Gripholst, Inc.
Reading Crane & Hoist Corp.
Round & Son, Inc., David
Ryerson & Son, Inc., Joseph T.
Shepard Niles Crane & Hoist Corp.
Silent Hoist & Crane Corp.
Templeton, Kenly & Co.
Thor Power Tool Co.
Uhrden, Inc.
Yale & Towne Mfg. Co. Yale Materials Handling Div.

360 HOISTS, LIFT, SHOP TYPE STATIONARY

AMERICAN HOIST & DERRICK CO.
Anthony Co.
Bartlett & Snow Co., C. O.
Clyde Iron Works, Inc.
Conco Engineering Works
Curtis Manufacturing Co.
Detroit Hoist & Machine Co.
Electro Lift, Inc.
GARDNER-DENVER CO.
Harrington Co.
HEWITT-ROBINS, INC.
INGERSOLL-RAND CO.
JOY MFG. CO.
Joyce-Cridland Co.
Lidgerwood Industries, Inc.
Manning, Maxwell & Moore, Inc. Shaw Box Crane & Hoist Div.
Novo Pump & Engine Co.
NATIONAL IRON CO.
Reading Crane & Hoist Corp.
Round & Son, Inc., David
Ryerson & Son, Inc., Joseph T.
SAUERMAN BROS. INC.
Shepard Niles Crane & Hoist Corp.
Silent Hoist & Crane Corp.
Superior-Lidgerwood-Mundy Corp.
Uhrden, Inc.

361 HOISTS, MINE SHAFT DRUM — does not include: Sheaves; Skips & Cages; Buckets

ATLAS COPCO PACIFIC, INC.
Clyde Iron Works Inc.
Coeur d'Alene Hardware & Foundry Co.
CONNELLSVILLE MFG. & MINE SUPPLY CO.
GARDNER-DENVER CO.
HEWITT-ROBINS, INC.
Hirsch Bros. Machy. Co.
Holmes & Bros., Inc. Robert
INGERSOLL-RAND CO.
JOY MFG. CO.
Lake Shore, Inc. Lake Shore Engineering Div.
Lidgerwood Industries, Inc.
MACHINERY CENTER, INC.
Manning, Maxwell & Moore, Inc. Shaw Box Crane & Hoist Div.
NORDBERG MFG. CO.
Rogers Iron Works Co.
Shepard Niles Crane & Hoist Corp.
STEARNS ROGER MFG. CO.
Superior-Lidgerwood-Mundy Corp.
VULCAN IRON WORKS CO., (DENVER)
Vulcan Iron Works
YUBA CONSOLIDATED INDUSTRIES, INC., YUBA MANUFACTURING DIV.

362 HOISTS, MINE SHAFT FRICTION—does not include: Sheaves, Skips & Cages; Buckets

ASEA ELECTRIC INC.
CONNELSVILLE MFG. & MINE SUP. PLY CO.
Clyde Iron Works, Inc.
Lidgerwood Industries, Inc.
Manning, Maxwell & Moore, Inc. Shaw Box Crane & Hoist Div.
Mayo Tunnel & Mine Equipment
NORDBERG MFG. CO.
Superior-Lidgerwood-Mundy Corp.

363 HOIST CONTROLS & ACCESSORIES, MINE SHAFT—also see Controls

LOGAN ENGINEERING CO.

(HOISTS, TUGGER — see Winches)

364 HOSE, AIR, STEAM, WATER, ET AL

Acme Rubber Mfg. Co.
Aeroquip Corp.
American Brass Co.
American Hard Rubber Co.
American Rubber Mfg. Co.
Arrowhead Products Div. Federal-Mogul-Bower, Bearings Inc.
ATLAS COPCO PACIFIC, INC.
Binks Mfg. Co.
BOSTON WOVEN HOSE & RUBBER CO.
Branford Co.
Carlyle Rubber Co.
CHICAGO PNEUMATIC TOOL CO.
Cincinnati Rubber Mfg. Co. Div. Thor Power Tool Co.
Continental Rubber Works
Drilling Accessory & Mfg. Co., Inc.
Eastman-Pacific Co.
EIMCO CORP.
Flexaust Co.
Flexible Tubing Corp.
Fyr-Fyter Co.
GATES RUBBER CO.
Gering Products, Inc.
Goodall Rubber Co.
GOODRICH INDUSTRIAL PRODUCTS CO. B. F.
GOODYEAR TIRE & RUBBER CO.
GOODYEAR TIRE & RUBBER CO. INDUSTRIAL PRODUCTS
Gray Co., Inc.
HAMILTON RUBBER MFG. CORP.
HEWITT-ROBINS, INC.
Industrial Air Products Co.
Johnson Corp.
LE ROI DIV., WESTINGHOUSE AIR BRAKE CO.
Lincoln Engineering Co. Div McNeil Machine & Engraving Co.
National Cylinder Gas, Div. Chemetron
New York Belting & Packing Co.
Newage Industries, Inc.
Pangborn Corp.
Pickard Industries, Inc., Central Mine Supply Co., Div.
PORTER COMPANY, INC., H. K. THERMOID DIV.
RAYBESTOS-MANHATTAN INC. MANHATTAN RUBBER DIV.
Republic Rubber Div. Lee Rubber & Tire Corp.
Snyder & Son, Inc., M. L.
STEWARD-WARNER CORP. ALEMITE DIV.
Stratoflex, Inc.
Thor Power Tool Co.
Titeflex, Inc.
U. S. RUBBER CO.
U. S. RUBBER CO. MECHANICAL GOODS DIV.
Wagner Electric Corp.
Weatherhead Co. Fort Wayne Div.

365 HOSE FITTINGS — CLAMPS, COUPLINGS, SWIVEL JOINTS, ETC.

Aeroquip Corp.
American Rubber Mfg. Co.
Arrowhead Products Div. Federal-Mogul-Bower, Bearings Inc.
ATLAS COPCO PACIFIC INC.
Band-It Co.
Binks Mfg. Co.
BOSTON WOVEN HOSE & RUBBER CO.
Branford Co.
Carlyle Rubber Co.
CHICAGO PNEUMATIC TOOL CO.
Chiksan Co.
Cleco Div., Reed Roller Bit Co.
Continental Rubber Works
CRANE CO.
Dixon Valve & Coupling Co.
Drilling Accessory & Mfg. Co., Inc.
Eastman Mfg. Co.
Eastman-Pacific Co.
Eaton Mfg. Co.
Fyr-Fyter Co.
GATES RUBBER CO.
Goodall Rubber Co.
GOODRICH INDUSTRIAL PRODUCTS CO., B. F.
GOODYEAR TIRE & RUBBER CO.
GOODYEAR TIRE & RUBBER CO. INDUSTRIAL PRODUCTS
Gray Co., Inc.
HEWITT-ROBINS, INC.
HOSE ACCESSORIES CO.
Hunt & Son, Inc., C. B.
Jordan Corp., Div. OPW Corp.
LE-HI DIV. HOSE ACCESSORIES CO.
LE ROI DIV., WESTINGHOUSE AIR BRAKE CO.
Lincoln Engineering Co. Div. McNeil Machine & Engineering Co.
Lunkenheimer Co.
Meckum Engineering, Inc.
Powell Co., Wm.
Punch-Lok Co.
PORTER COMPANY, INC., H. K., THERMOID DIV.
RAYBESTOS-MANHATTAN, INC. MANHATTAN RUBBER DIV.
Snyder & Son, Inc., M. L.
STEWART-WARNER CORP. ALEMITE DIV.
Stratoflex, Inc.
Thor Power Tool Co.
Titeflex, Inc.
U. S. RUBBER CO.
Weatherhead Co. Fort Wayne Div.

366 HUBS, AUTO WHEEL, SELECTIVE DRIVE

INTERNATIONAL HARVESTER CO.
Rockwell Spring & Axle Co. Timken-Detroit Axle Div.
WARN MFG. CO.

(HYDRAULIC CYLINDERS — see Cylinders, Air & Hydraulic)

(HYDRAULIC MONITOR — see Monitors)

367 HYDRAULIC MOTORS

Commercial Shearing & Stamping Co.

LINK-BELT CO.
Oilgear Co.
Rockwell Mfg. Co., Hydraulics Div.
Vickers Inc. Administrative & Engineering Center

(HYDRAULIC PUMPS — see Pumps, Hydraulic Fluid)

(HYDRAULIC RAMS — see Pumps, Hydraulic Ram)

(HYDROMETER—see Meters, Liquid Density)

I

(INSTRUMENTS—see: Drafting Equipment; Geophysical Instruments; Chemical Laboratory Equipment; Laboratory & Scientific Instruments, Equipment & Supplies; Meters; Surveying Equipment)

368 INSULATING MATERIALS, ELECTRICAL

American Lava Corp.
Anderson Mfg. Co., Albert & J. M.
Brady Co., W. H.
Continental-Diamond Fibre Corp. A Subsidiary of Budd Co.
Corning Glass Works
DOW CORNING CORP.
DuPont de Nemours & Co., Inc. E. I. Fabrics Div.
Duquesne Mine Supply Co.
G & W Electric Specialty Co.
Graybar Elec. Co., Inc.
Irvington Div. Minnesota Mining & Mfg. Co.
Johns-Manville
Keasbey & Mattison Co.
Metal & Thermit Corp.
Mica Insulator Div., Minnesota Mining & Mfg. Co.
National Vulcanized Fibre Co.
PHELPS DODGE COPPER PRODUCTS CORP.
Plymouth Rubber Co.
Punch-Lok Co.
PORTER COMPANY, INC., H. K., THERMOID DIV.
Ruberoid Co.
Sauereisen Cement Co.
Silicones Div., Union Carbide Corp.
Synthane Corp.
Taylor Fibre Co.
Thiokol Chemical Corp.
U. S. RUBBER CO.
West Virginia Pulp & Paper Co.
WESTINGHOUSE ELECTRIC CORP.
Zophar Mills, Inc.

369 INSULATING MATERIALS, MOISTURE & GAS

BEMIS BRO. BAG CO.
Corning Gass Works
Johns-Manville
Zophar Mills, Inc.

370 INSULATING MATERIALS, SOUND

BEMIS BRO. BAG CO.
Carey Mfg. Co., Philip
Corning Glass Works
Eagle-Picher Co.
Gustin-Bacon Mfg. Co.
HEWITT-ROBINS, INC.
Johns-Manville
Keasbey & Mattison Co.
Laubenstein Mfg. Co.
Pacific Lumber Co.
U. S. RUBBER CO.

371 INSULATING MATERIALS, THERMAL, BLOCK & BOARD—also see Refractories

Bigelow-Liptak Corp.
Carey Mfg. Co., Philip
DOW CHEMICAL CO.
Eagle-Picher Co.
General Refractories, Co.
Green Fire Brick Co., A. P.
Johns-Manville
Kaiser Aluminum & Chemical Sales, Inc.
Keasbey & Mattison Co.
Mexico Refractories Co.
MULLITE WORKS REFRACTORIES DIV. H. K. PORTER COMPANY, INC.
North American Refractories Co.
Pittsburg-Corning Corp.
Quigley Co., Inc.
Refractory & Insulation Corp.
Robinson Clay Product Co.
Ruberoid Co.

372 INSULATING MATERIALS, THERMAL, BULK also see Refractories

BABCOCK & WILCOX CO.
Bigelow-Liptak Corp.
Carey Mfg. Co., Philip
Eagle-Picher Co.
General Refractories, Co.
Green Fire Brick Co., A. P.
Gustin-Bacon Mfg. Co.
Ironton Fire Brick Co.
Johns-Manville
Kaiser Aluminum & Chemical Sales, Inc.
Keasbey & Mattison Co.
Laclede-Christy Works, Refractories Div. H. K. Porter Co., Inc.
Mexico Refractories Co.
MULLITE WORKS REFRACTORIES DIV. H. K. PORTER COMPANY, INC.
North American Refractories Co.
Norton Co.
Pacific Lumber Co.
Pettinos Inc., George F.
Pittsburg-Corning Corp.
Quigley Co., Inc.
Refractory & Insulation Corp.
Robinson Clay Product Co.

373 INSULATING MATERIALS, THERMAL, CASTABLE & CEMENT COMPOUNDS — also see Refractories

BABCOCK & WILCOX CO.
Bigelow-Liptak Corp.
Carey Mfg. Co., Philip
Corhart Corp.
DOW CORNING CORP.
Eagle-Picher Co.
Green Fire Brick Co., A. P.
HEWITT-ROBINS, INC.
Ironton Fire Brick Co.
Kaiser Aluminum & Chemical Sales, Inc.
Johns-Manville
LACLEDE-CHRISTY WORKS, REFRACTORIES DIV., H. K. PORTER CO., INC.
Mexico Refractories Co.
MULLITE WORKS REFRACTORIES DIV. H. K. PORTER COMPANY, INC.
North American Refractories Co.
Norton Co.
Quigley Co., Inc.
Refractory & Insulation Corp.
Robinson Clay Product Co.
Sauereisen Cement Co.

374 INSULATING MATERIALS, THERMAL, CLOTH & PAPER

Carey Mfg. Co., Philip
Gatke Corp.
Johns-Manville
Keasbey & Mattison Co.
Ruberoid Co.
Union Asbestos & Rubber Co.

375 ION EXCHANGE EQUIPMENT (SPECIAL)—does not include standard auxiliary equipment; also see Water Clarification

ALLIS-CHALMERS MFG. CO.
American Water Softener Co.
Brosites Products Corp.
Chemical Separations Corp.
Cochrane Corp.
DORR-OLIVER, INC.
Enley Products, Inc.
Graver Water Conditioning Co.
Hagan Chemicals & Controls, Inc. Divisions: Calgon Co., Hall Laboratories
Higgins Co., I. R.
INFILCO, INC.
Ionics, Inc.
PERMUTIT CO., DIV. PFAUDLER PERMUTIT INC.
TURBO-MIXER DIV. GENERAL AMERICAN TRANSPORTATION CORP.
WEMCO, DIV. WESTERN MACHINERY CO.

376 ION EXCHANGE RESINS

ALLIS-CHALMERS MFG. CO. INDUSTRIES GROUP
American Water Softener Co.
Chemical Process Co.
Cochrane Corp.
DOW CHEMICAL CO.
Enley Products, Inc.
Graver Water Conditioning Co.
Hagan Chemicals & Controls, Inc. Divisions: Calgon Co., Hall Laboratories
PERMUTIT CO. DIV. PFAUDLER PERMUTIT INC.
Rohm & Haas Co.
Van Waters & Rogers, Inc.

J

377 JACKS, LIFTING, (SCREW, HYDRAULIC, ETC.)—also see: Hoists; Jacks, Roof

Badger Malleable & Mfg. Co.
Blackhawk Mfg. Co.
Clark Controller Co.
Duff Norton Co.
Foster Co., L. B.
Frank, M. K.
Gibraltar Equipment & Mfg. Co.
Illinois Iron & Bolt Co.
Ionics, Inc.
Joyce-Cridland Co.
Moran Engineering Co.
Owatonna Tool Co.
Star Jack Co.
Swett Iron Works, A. L.
Templeton, Kenly & Co.
Uhrden, Inc.

(JACKS, PULLING — see Hoists)

378 JACKS, ROOF—also see Mine Supports, Re-usable Props

Duff Norton Co.
Foster Co., L. B.
Hales Co., W. M.
Herold Mfg. Co.
Joyce-Cridland Co.
Star Jack Co.
Templeton, Kenly & Co.

(JIGS—see Separators, Jig)

K

(KILNS, ROASTERS & DRYERS — see below; also see: Dryers, Furnaces; Retorts; Sintering Equipment

379 KILNS, ROASTERS & DRYERS, BEEHIVE, TUNNEL & SINGLE HEARTH (STATIONARY & MOVING)

ALLIS-CHALMERS MFG. CO.
Bigelow-Liptak Corp.
DORR-OLIVER, INC.
Harper Electric Furnace Corp.
Heineken, Inc. W. P.
Hevi-Duty Electric Co.
KENNEDY-VAN SAUN MFG. & ENG. CORP.
Kirk & Blum Mfg. Co.
STEARNS ROGER MFG. CO.

380 KILNS, ROASTERS & DRYERS, ROTARY

ALLIS-CHALMERS MFG. CO.
Bartlett & Snow Co., C. O.
Canadian Locomotive Co., Ltd.
Carpco Manufacturing, Inc.
DIESEL ENERGY CORP.
GENERAL AMERICAN TRANSPORTATION CORP.
GENERAL AMERICAN TRANSPORTATION CORP., LOUISVILLE DRYER DIV.
GOULD CO., GORDON I.
HARDINGE CO., INC.
Hack Engineering Co.
Heineken, Inc. W. P.
KENNEDY-VAN SAUN MFG. & ENG. CORP.
MACHINER CENTER, INC.
McNALLY PITTSBURGH MFG. CORP.
MINE & SMELTER SUPPLY CO., MFG. DIV.
NORDBERG MFG. CO.
Ogden Iron Works
Pacific Coast Engineering Co.
Salem-Brosius, Inc.
SMIDTH & CO., F. L.
Standard Steel Corp.
STEARNS ROGER MFG. CO.
Stroh Process Steel Co.
TRAYLOR ENGINEERING & MFG. CO.
VULCAN IRON WORKS
Washington Machinery Co.
YUBA CONSOLIDATED INDUSTRIES, INC.

(KILNS, ROASTERS & DRYERS, SHAFT—see Furnaces, Shaft)

381 KILNS, ROASTERS & DRYERS, MULTIPLE-HEARTH (MECHANICAL RABBLE) TOWER

ALLIS-CHALMERS MFG. CO.
Canadian Locomotive Co., Ltd.
DORR-OLIVER, INC.
Heineken, Inc. W. P.
Kaiser Aluminum & Chemical Sales, Inc.
MINE & SMELTER SUPPLY CO., MFG. DIV.
NICHOLS ENGINEERING & RESEARCH CORP.
Pacific Foundry Co., Ltd.
STEARNS ROGER MFG. CO.

381A KILN (& INDUSTRIAL) GUNS (DECLOGGING)—does not include Refractory Placers

Remington Arms Co., Inc.

L

382 LABORATORY & SCIENTIFIC INSTRUMENTS, EQUIPMENT & SUPPLIES other than Chemical Lab. Equip., Geophysical Instruments, Drafting Equipment, Surveying Equipment—also see Meters

American Instrument Co., Inc.
American Paulin System
Assembly Products, Inc.
BAKER & ADAMSON PRODUCTS, GENERAL CHEMICAL DIV., ALLIED CHEMICAL CORP.
Bartlett & Snow Co., C. O.
Bausch & Lomb Optical Co.
Beckman Instruments, Inc., Scientific & Process Instruments Div.
Bico, Inc.
Blue M Electric Co.
Booth Co.
Cargille Laboratories, Inc. R. P.
Carpco Manufacturing, Inc.
Central Scientific Co.
Charles Engelhard, Inc.
Consolidated Electrodynamics Corp.
Coors Porcelain Co.
Corning Glass Works
CURTISS-WRIGHT CORP. ELECTRONICS DIV.
Denver Equipment Co.
Electronics Div., Diamond Power Specialty Corp.
Esterline-Angus Co., Inc.
Fahrenwald Co., A. W.
Fischer & Porter Co.
Fisher Research Laboratory, Inc.
Fisher Scientific Co.
Galigher Co.
Gerber Scientific Instrument Co.
Gray Instrument Co.
Gurley, M. & L. E.
Hagan Chemicals & Controls, Inc. Divisions: Calgon Co. Hall Laboratories
Holmes & Bros., Inc. Robert
Industrial Overlay Metals, Inc.
INDUSTRIAL PHYSICS & ELECTRONICS CO.
Jarrell-Ash Co.
Knopp, Inc.
Ledoux & Co.
Leeds & Northrup Co.
Mallinckrodt Chemical Works
Mead Mill Co.
Metals Disintegrating Co. Inc. Pulverizing Machinery Div.
MINE & SMELTER SUPPLY CO., MFG. DIV.
MINNEAPOLIS-HONEYWELL REGULATOR CO.
MIXING EQUIPMENT CO.
Morse Bros. Machinery Co.
Norton Co.
Perkin Engineering Co.
Pettinos, Inc., George F.

Philips Electronics, Inc. Instruments Div.
Radiation Counter Laboratories, Inc.
Sharples Corp.
Southwestern Industrial Electronics Co.
STURTEVANT MILL CO.
Torsion Balance Co.
TURBO-MIXER DIV. GENERAL AMERICAN TRANSPORTATION CORP.
Ultra-Violet Products, Inc.
Universal Vibrating Screen Co.
Voland & Sons, Inc.
Van Waters & Rogers, Inc.
WESTERN MACHINERY CO.

383 LABORATORY SERVICE, CHEMICAL ANALYZING & ASSAYING

American Spectrographic Laboratories, Inc.
Arizona Assay Office.
Arizona Testing Laboratories
Booth Co.
California Testing Laboratories, Inc.
Carpco Manufacturing Inc.
Chapman, Wood & Griswold
Chemalco Inc.
Commercial Testing & Engrg. Co.
Custom Assay Office
Denver Ore Testing Div., Denver Equipment Co.
Dickinson Laboratories, Inc.
Electronics Div., Diamond Power Specialty Corp.
El Paso Testing Laboratories
Geophysical Instrument & Supply Co.
Goodall Brothers
Hagan Chemicals & Controls Inc. Divisions: Calgon Co., Hall Laboratories
Hanks, Inc., Abbot A.
Hawley & Hawley, Assayers & Chemists, Inc.
Jarrell-Ash Co.
Ledoux & Co.
McDowell Co., Inc.
Nichols Laboratories, Inc.
Pitkin, Inc., Lucius
Smith-Emery Co.
Snell, Inc., Foster D.
Spectrochemical Laboratories, Inc.
Stowell & Co., W. H.
Taller & Cooper Inc.
Tour & Co., Sam
Tracerlab, Inc.
Ultra-Violet Products, Inc.
U. S. Testing Co., Inc.
Walker & White, Inc.
WEMCO, DIV. WESTERN MACHINERY CO.
Wood Assaying Co., Henry F.

384 LABORATORY SERVICE, MINERAL DETERMINATION

Carpco Mfg., Inc.
Denver Ore Testing Div., Denver Equipment Co.
Galigher Co.
Jarrell-Ash Co.
Pitkin, Inc., Lucius
Smith-Emery Co.
Southwestern Engineering Co.
Tour & Co., Inc.
U. S. Testing Co., Inc.

385 LABORATORY SERVICE, TESTING other than chemical & mineral above—also see: Consultants; Contractors

Chemical Separations Corp.
Pitkin, Inc., Lucius
Smith-Emery Co.
Tour & Co., Inc.
U. S. Testing Co., Inc.

386 LIGHTING FIXTURES & LAMPS, INDUSTRIAL (ELECTRIC) — also see Flood Lights

Appleton Electric Co.
Circle F Mfg. Co.
Concordia Electric Co.
Crouse Hinds Co.
Femco, Inc.
Guyan Machy. Co.
Line Material Industries McGraw-Edison Co.
Multi Electrical Mfg. Co.
Phoenix Products Co.
Pittsburgh Reflector Co.
Pyle-National Co.
Ray-O-Vac Co., Div. Electric Storage Battery Co.
Steber Mfg. Co.
Sylvania Electric Products, Inc.
WESTINGHOUSE ELECTRIC CORP.

(LININGS & CLADDINGS—see below; also see: Furnace Linings; Insulating Materials Steel, Alloy; Tanks, Lined; does not include Coatings)

(LININGS, ABRASION RESISTANT, METALLIC—see: Hardfacing; Metalizing; Steel, Alloy)

387 LININGS & CLADDINGS, ABRASION, RESISTANT, NON-METALLIC

Acme Rubber Mfg. Co.
AMERCOAT CORP.
Bigelow-Liptak Corp.
Bonded Scale & Machine Co.
Byers Co., A. M.
Carboline Co.
Carey Mfg. Co., Philip
Denver Equipment Co.
DuPont de Nemours & Co., Inc., E. I. Fabrics Div.
Galigher Co.
Garlock Packing Co.
Gates Engr. Co.
Goodall Rubber Co.
GOODRICH INDUSTRIAL PRODUCTS CO., B. F.
GOODYEAR TIRE & RUBBER CO.
Green Fire Brick Co., A. P.
HAMILTON RUBBER MFG. CORP.
Haynes Stellite Co. Div. Union Carbide Corp.
Ironton Fire Brick Co.
LINATEX CORP. OF AMERICA
Mexico Refractories Co.
New York Belting & Packing Co.
Norton Co.
Permaglie Corp. of America
Pickard Industries, Inc. Central Mine Supply Co., Div.
Pipe Linings, A Div. of American Pipe & Construction Co.
Porcelain Div., Ferro Corp.
PORTER COMPANY, INC., H. K. THERMOID DIV.
Quigley Co., Inc.
RAYBESTOS-MANHATTAN, INC. MANHATTAN RUBBER DIV.
Republic Rubber Div. Lee Rubber & Tire Corp.
Sauereisen Cement Co.
Thomas Foundries, Inc.
U. S. RUBBER CO.
U. S. RUBBER CO. MECHANICAL GOODS DIV.
YUBA CONSOLIDATED INDUSTRIES, INC., YUBA MINING DIV.

388 LININGS & CLADDINGS, CORROSION - RESISTANT METALLIC—Steel, Alloy; Tanks, Lined

Alco Products, Inc.
Aluminum Co. of America
AMERCOAT CORP.
AMERICAN BRAKE SHOE CO. AMERICAN MANGANESE STEEL DIV.
Ampco Metal Inc.
Atlas Steels, Ltd.
BABCOCK & WILCOX CO.
Byers Co., A. M.
Carboline Co.
CRUCIBLE STEEL CO. OF AMERICA
DENVER EQUIPMENT CO.
Galigher Co.
GENERAL AMERICAN TRANSPORTATION CORP.
Graver Tank & Mfg. Co., Div. Union Tank Car Co.
Haynes Stellite Co. Div. Union Carbide Corp.
Irwin-Sensenich Corp.
Jessop Steel Co.
Klemp Metal Grating Corp.
Reilly Tar and Chemical Corp.

389 LININGS & CLADDINGS, CORROSION - RESISTANT, NON-METALLIC —also see: Tanks, Lined

Acme Rubber Mfg. Co.
AMERCOAT CORP.
American Hard Rubber Co.
Bigelow-Liptak Corp.
Byers Co., A. M.
Carboline Co.
Denver Equipment Co.
DuPont de Nemours & Co., Inc., E. I. Fabrics Div.
Formica Corp. Subsidiary of Cyanamid
Galigher Co.
Garlock Packing Co.
Gates Engrg. Co.
Goodall Rubber Co.
GOODRICH INDUSTRIAL PRODUCTS CO., B. F.
GOODYEAR TIRE & RUBBER CO. INDUSTRIAL PRODUCTS
GOODYEAR TIRE & RUBBER CO.
HAMILTON RUBBER MFG. CORP.
LINATEX CORP. OF AMERICA
Luzerne Rubber Co.
Metal & Thermit Corp.
National Carbon Co. Union Carbide Corp.
Norton Co.
Patterson Foundry & Machine Co.
Pennsalt Chemicals Corp.
Permaglie Corp. of America
Porcelain Div., Ferro Corp.
PORTER COMPANY, INC., H. K., THERMOID DIV.
Quigley Co., Inc.
RAYBESTOS-MANHATTAN, INC. MANHATTAN RUBBER DIV.
Ryerson & Son, Inc., Joseph T.
Sauereisen Cement Co.
U. S. RUBBER CO.
U. S. RUBBER CO. MECHANICAL GOODS DIV.
Wilbur & Williams Co.

(LOADERS—see below; also see: Conveyors; Dredges; Excavators; Scrapers; Trucks & Trailers Self-Loading)

390 LOADERS, BOXCAR

HOUGH CO., FRANK G.
Lippmann Engineering Works, Inc.
LINK-BELT CO.
MC NALLY PITTSBURG MFG. CORP.
Ottumwa Box Car Loader Co.
Specialty Engineering Co.
Stephens-Adamson Mfg. Co.

391 LOADERS, SELF-LOADING CONVEYOR, (CHAIN, BELT, BUCKET-LINE, ETC.) WITH DIGGING COMPONENT — does not include: Excavators; Bucket-wheel; or Conveyor alone. Also, see: Loaders, Gathering-Head, Mine-Type

ATHEY PRODUCTS CORP.
BARBER-GREENE CO.
Bonded Scale & Machine Co.
Butler Bin Co.
Chain Belt Co.
Christian Engineers, J. D.
Erie Strayer Co.
Gibraltar Equipment & Mfg. Co.
Goodman Mfg. Co.
Hack Engineering Co.
Herold Mfg. Co.
HEWITT-ROBINS, INC.
Heyl & Patterson, Inc.
Irwin-Sensenich Corp.
LE TOURNEAU-WESTINGHOUSE CO.
LINK-BELT CO.
Lippmann Engineering Works, Inc.
Pickard Industries, Inc. Central Mine Supply Co., Div.
Specialty Engineering Co.
Stephens-Adamson Mfg. Co.
Universal Dredge Mfg. Co.
Washington Machinery Co.

392 LOADERS, FRONT-END SCOOP, CRAWLER-TRACTOR—does not include overcast type

ALLIS-CHALMERS MFG. CO.
Ateco Div. Greenville Steel Car Co.
CASE CO., J. I. INDUSTRIAL DIV.
CATERPILLAR TRACTOR CO.
Drott Mfg. Co.
EIMCO CORP.
HOUGH CO., FRANK G.
Hyster Co.
INTERNATIONAL HARVESTER EXPORT CO.
JOY MFG. CO.
Koehring Co.
Link-Belt Speeder Corp.
MACHINERY CENTER, INC.
Myers-Whaley Co., Inc.
Oliver Corp.
Sanford-Day Iron Works, Inc.
Thew Shovel Co.
TRACTOMOTIVE CORP.

393 LOADERS, FRONT-END SCOOP, WHEELED TRACTOR—does not include overcast type

ALLIS-CHALMERS MFG. CO.
Baker Industrial Trucks, Div. Otis Elevator Co.
BALDWIN-LIMA-HAMILTON CORP., CONSTRUCTION EQUIPMENT DIV.
CASE CO., J. I. INDUSTRIAL DIV.
CLARK EQUIPMENT CO. CONSTRUCTION MACHINERY DIV.
DEERE CO., JOHN
EUCLID DIV., GENERAL MOTORS CORP.
HOUGH CO., FRANK G.
Hyster Co.
INTERNATIONAL HARVESTER EXPORT CO.
LE ROI DIV., WESTINGHOUSE AIR BRAKE CO.
Myers-Whaley Co., Inc.
Oliver Corp.
Pettibone Mulliken Corp.
Sanford-Day Iron Works, Inc.
Schramm, Inc.
Thew Shovel Co.
TRACTOMOTIVE CORP.
Yale & Towne Mfg. Co., Yale Materials Handling Div.

394 LOADERS, GATHERING-HEAD, MINE-TYPE — also see: Loaders, Self-loading Conveyor

GARDNER DENVER CO.
Goodman Mfg. Co.
JEFFREY MFG. CO.
JOY MFG. CO.
Long Co
Myers-Whaley Co., Inc.

395 LOADERS, OVERCASTING BUCKET, MINE-TYPE, CRAWLER, RAIL & WHEELED

ATLAS COPCO PACIFIC, INC.
ATLAS COPCO EASTERN, INC.
EIMCO CORP.
GARDNER-DENVER CO.
JOY MFG. CO.
MACHINERY CENTER, INC.

396 LOADERS, SCRAPER-SLUSHER MOVABLE RAMP

Rogers Iron Works Co.

397 LOADERS, SPECIAL MINE SHAFT MUCKING

BLAW KNOX CO.
Boland Development Co. Ltd.
BUCYRUS-ERIE CO.
EIMCO CORP.
GARDNER-DENVER CO.
JOY MFG. CO.
MACHINERY CENTER INC.
Riddell, J. Murray
Ruhr Industries
Sanford-Day Iron Works, Inc.
Shaft Development Machines, Inc.
Sturrock & Co. Ltd.

398 LOADERS, SPECIAL TUNNEL MUCKING — also see: Trucks & Trailers, Special Self-Loading

EIMCO CORP.
Goodman Manufacturing Co.
Myers-Whaley Co., Inc.

399 LOADING ATTACHMENTS, SPECIAL FOR SELF-LOADING VEHICLES

EIMCO CORP.

(LOADING BOOMS — see: Conveyors; Cranes)

400 LOCOMOTIVES, COMPRESSED AIR

EIMCO CORP.
Hack Engineering Co.
MACHINERY CENTER INC.
Mayo Tunnel & Mine Equipment
Universal Dredge Mfg. Co.

401 LOCOMOTIVES, ELECTRIC BATTERY & TROLLEY

Atlas Car & Mfg. Co.
Easton Car & Construction Co.
Frank, M. K.
GENERAL ELECTRIC CO. APPARATUS SALES DIV.
Greensburg Machine Co.
Goodman Manufacturing Co.
Ironton Engine Co.
JEFFREY MFG. CO.
Kersey Mfg. Co., Inc.
MACHINERY CENTER INC.
MANCHA STORAGE BATTERY LOCOMOTIVE DIV. GOODMAN MFG. CO.
Moran Engineering Co.
NATIONAL MINE SERVICE CO.
TREADWELL CO., M. H.
Universal Dredge Mfg. Co.
West Virginia Armature Co.

402 LOCOMOTIVES, GASOLINE, DIESEL & DIESEL-ELECTRIC

AlcoProducts, Inc.
Atlas Car & Mfg. Co.
Brockville Locomotive Works
Canadian Locomotive Co., Ltd.
DIESEL ENERGY CORP.
DIFFERENTIAL STEEL CAR CO.
FAIRBANKS, MORSE & CO.
Frank, M. K.
GENERAL ELECTRIC CO. APPARATUS SALES DIV.
GENERAL MOTORS CORP. ELECTRO-MOTIVE DIV.
Hack Engineering Co.
INTERNATIONAL HARVESTER EXPORT CO.
MANCHA STORAGE BATTERY LOCOMOTIVE DIV. GOODMAN MFG. CO.
Mayo Tunnel & Mine Equipment
Minerals Engineering Co.
NATIONAL MINE SERVICE CO.
PLYMOUTH LOCOMOTIVE WORKS DIV. FATE, ROOT-HEATH CO.
ROGERS BROTHERS CORP.
Ruth Co.
Telluride Iron Works Co.
Westinghouse Air Brake Co.

403 LOCOMOTIVES, STEAM

Frank, M. K.

(LOG WASHERS—see Scrubbers)

404 LUBRICANTS

Alpha Molykote Corp.
AMERICAN METAL CLIMAX, INC., CLIMAX MOLYBDENUM CO. DIV.
American Oil Co.
Arkansas Fuel Oil Corp.
Atlantic Refining Co.
Borne Chemical Co., Inc.
Brooks Oil Co.
Cabot, Inc., Samuel
Cities Services Oil Co.
Dixon Crucible Co., Joseph
Dow Corning Corp.
Esso Standard Oil Co. National & Comm. Sales Div.
Felt Products Mfg. Co.
Gulf Oil Corp.
Hales Co., W. M.
Houghton & Co., E. F.
Hulburt Oil & Grease Co.
Imperial Oil & Grease
Jesco Lubricants Co.
Jet-Lube, Inc.
Keystone Lubricating Co.
LESCHEN WIRE ROPE DIV. H. K. PORTER COMPANY, INC.
Lockrey Co.
LUBRIPLATE DIV. FISKE BROS. REFINING CO.
New York & New Jersey Lubricant Co.
Ohio Grease Co.
Ohio Oil Co.
Pettinos, Inc., George F.
Phillips Petroleum Co.
Pure Oil Co.
Shell Oil Co.
Silicones Div., Union Carbide Corp.
Sinclair Refining Co.
Socony Mobil Oil Co.
STANDARD OIL CO., OF CALIFORNIA
STEWART-WARNER CORP ALEMITE WESTERN OPERATIONS, INC. DIV.
Standard Oil Co.—Indiana
Sun Oil Co.
TEXAS CO.
Union Carbide Chemicals Co., Union Carbide Corp.
Valvoline Oil Co. Div. Ashland Oil & Refining Co.
Whitmore Mfg. Co.

405 LUBRICATING EQUIPMENT

Farval Corp.
Frantz Co., Inc. S. G.
Gibraltar Equipment & Mfg. Co.
Gray Co., Inc.
Hales Co., W. M.
Hills-McCanna Co.
Lincoln Engineering Co. Div. McNeil Machine & Engineering Co.
Lunkenheimer Co.
Manzel Div. Houdaille Industries, Inc.
Powell Co., Wm.
STEWART-WARNER CORP. ALEMITE DIV.
Thor Power Tool Co.
Trico Fuse Mfg. Co.
Wilkerson Corp.

M

406 MAGNETS — also see Separators, Magnetic

Carpco Manufacturing, Inc.
CRUCIBLE STEEL CO. OF AMERICA
Cutler-Hammer, Inc.
Dings Magnetic Separator Co.
Electric Controller & Mfg. Co. Div. Square D. Co.
Erlez Mfg. Co.
Homer Mfg. Co.
Magnetic Engineering & Mfg. Co.
Metalurgical Products Dept. General Electric Co.
Shrader Co., F. W.
Stackpole Carbon Co.
STEARNS MAGNETIC PRODUCTS
VARIAN ASSOCIATES

407 MAPS, GEOGRAPHIC — does not include Contractors, Mapping

Abrams Aerial Survey Corp.
AERO SERVICE CORP.
Aero Service Corp. (Mid-Continent)
Aero Service Corp. (Western)
Aero Service Corp. de Venezuela C. A.
African Surveys (Pty.) Ltd.
American Air Surveys, Inc.
Ammann Photogrammetric Engineers, Inc., Jack
Canadian Aero Service Ltd.
Fairchild Aerial Surveys, Inc.
Spartan Air Services, Ltd.

METALLIZING EQUIPMENT

Consolidated Electrodynamics Corp.
Jarrell-Ash Co.
Metallizing Engineering Co., Inc.

409 METALLIZING SUPPLIES—also see Welding Supplies

American Chain & Cable Co., Inc. Page Steel & Wire Div.
CRUCIBLE STEEL CO. OF AMERICA
Hales Co., W. M.
Metallizing Engineering Co., Inc.
Vanadium-Alloys Steel Co.

410 METERS & GAGES, INDICATING & MEASURING DEVICES & INSTRUMENTS (REMOTE, RECORDING, ETC.) — see below; also see: Bin-Level Indicators; Communications; Controls; Drafting Instruments; Gas (& Moisture) Detectors; Geophysical Instruments; Chemical Laboratory Equipment; Laboratory & Scientific Instruments; Scales; Surveying Instruments; Spectroscopic Instruments

ABCs Scale Div. McDowell Co., Inc.
American Instrument Co., Inc.
Auto-Lite Battery Corp.
Bailey Meter Co.
BALL BROTHERS RESEARCH CORP.
Bausch & Lomb Optical Co.
Beckman Instruments, Inc. Berkeley Div.
B-I-F Industries, Inc.
Bristol Co.
Charles Engelhard, Inc.
Chatillon & Sons, John
Consolidated Electrodynamics Corp.
Convair
CURTISS-WRIGHT CORP. ELECTRONICS DIV.
DIFFERENTIAL STEEL CAR CO.
Electronics Div., Diamond Power Specialty Corp.
El-Tronics, Inc.
Esterline-Angus Co., Inc.
Fischer & Porter Co.
Fisher Research Laboratory, Inc.
Fisher Scientific Co.
Foxboro Co.
GENERAL ELECTRIC CO. APPARATUS SALES DIV.
General Equipment & Mfg. Co.
Gerber Scientific Instrument Co.
Gray Instrument Co.
Hagan Chemicals & Controls, Inc. Divisions: Calgon Co., Hall Laboratories
Illinois Testing Laboratories, Inc.
Industrial Overlay Metals, Inc.
INDUSTRIAL PHYSICS & ELECTRONICS CO.
Isotope Products, Inc. Instrument Div.
Leeds & Northrup Co.
Lonergan Co., J. E.
Meriam Instrument Co.
MERRICK SCALE MFG. CO.
MINE SAFETY APPLIANCES CO.
MINNEAPOLIS-HONEYWELL REGULATOR CO.
MINNEAPOLIS-HONEYWELL REGULATOR CO. BROWN INSTRUMENT DIV.
MINNEAPOLIS-HONEYWELL REGULATOR CO. INDUSTRIAL DIV.
New Jersey Meter Co.
Newage Industries, Inc.
Norden-Ketay Corp.
Nuclear Research Corp.
Penberthy Mfg. Co.
Radiation Counter Laboratories
Rawson Electrical Instrument Co.
Republic Flow Meters Co.
Rockwell Mfg. Co., Meter & Valve Div.
Schroeder Brothers
Southwestern Industrial Electronics Co.
Sprengnether Instrument Co., Inc.,
Texas Instruments, Inc. Industrial Instrumentation Div.
Tracerlab, Inc.
Uehling Instrument Co.
U. S. Gauge Div. American Machine
Universal Atomics Div. Universal Transistor Products Corp.
Vapor Recovery Systems Co.
VARIAN ASSOCIATES
Weston Instruments, Div. Daystrom, Inc.
Wheelco Instr. Div., Barber-Colman Co.
Yarnall-Waring Co.

411 METERS & GAGES, ETC., CHEMICAL (pH POLAROGRAPH, ETC.)

American Instrument Co., Inc.
Analytical Measurements, Inc.
Bailey Meter Co.
Beckman Instruments, Inc., Scientific & Process Instruments Div.
Bristol Co.
Central Scientific Co.
Consolidated Electrodynamics Corp.
CURTISS-WRIGHT CORP. ELECTRONICS DIV.
Fisher Scientific Co.
Foxboro Co.
Industrial Overlay Metals, Inc.
INDUSTRIAL PHYSICS & ELECTRONICS CO.
Jarell-Ash Co.
Leeds & Northrup Co.
Macbeth Daylighting Corp.
MINNEAPOLIS-HONEYWELL REGULATOR CO.
MINNEAPOLIS-HONEYWELL REGULATOR CO. BROWN INSTRUMENT DIV.
MINNEAPOLIS-HONEYWELL REGULATOR CO. INDUSTRIAL DIV.
Taylor & Co., W. A.
Uehling Instrument Co.
Wheelco Instrument Div., Barber-Colman Co.

412 METERS & GAGES, ETC., COUNTING

Beckman Instruments, Inc.
Bristol Co.
CURTISS-WRIGHT CORP. ELECTRONICS DIV.
Electro Products Laboratories
Fischer & Porter Co.
Gurley, M. & L. E.
Nuclear Research Corp.
Rockwell Mfg. Co.
Tracerlab, Inc.
Uehling Instrument Co.
Van Waters & Rogers, Inc.
VARIAN ASSOCIATES

413 METERS & GAGES, ETC., ELECTRICITY (AMMETERS, VOLTMETERS, ET AL)

AMERICAN CYANAMID CO.
Assembly Products, Inc.
Auto-Lite Battery Corp.
Beckman Instruments, Inc.
Bristol Co.
Charles Engelhard, Inc.
Columbia Electric Mfg. Co.
Consolidated Electrodynamics Corp.
CURTISS-WRIGHT CORP. ELETRONICS DIV.
DuPont de Nemours & Co., E. I.
Esterline-Angus Co., Inc.
GENERAL ELECTRIC CO. APPARATUS SALES DIV.
Graybar Elec. Co., Inc.
HERCULES POWDER CO.
Knopp, Inc.
Lafayette Radio Corp.
Leeds & Northrup Co.
MINNEAPOLIS-HONEYWELL REGULATOR CO. BROWN INSTRUMENT DIV.
Sangamo Electric Co.
Southwestern Industrial Electronics Co.
STEWART-WARNER CORP. ALEMITE DIV.
Texas Instruments, Inc. Industrial Instrumentation Div.
Uehling Instrument Co.
U. S. Gauge Div., American Machine & Metal, Inc.
VARIAN ASSOCIATES
Wheelco Instr. Div., Barber-Colman Co.
WESTINGHOUSE ELECTRIC CORP.
Weston Electrical Instrument Corp. Subsidiary of Daystrom, Inc.

414 METERS & GAGES, ETC., FLUID (FLOW, PRESSURE & VACUUM)

American Chain & Cable Co., Inc. Helicoid Gage Div.
American Paulin System
Auto-Lite Battery Corp.
Bailey Meter Co.
Beckman Instruments, Inc.
B-I-F Industries, Inc.
Binks Mfg. Co.
Brabender Corp.
Bristol Co.
Central Scientific Co.
Consolidated Electrodynamics Corp.
Crosby Valve & Gage Co.
Esterline-Angus Co., Inc.
Falcon Alarm Co., Inc.
Fischer & Porter Co.
Foxboro Co.
GENERAL ELECTRIC CO. APPARATUS SALES DIV.
Hagan Chemicals & Controls, Inc. Divisions Calgon Co., Hall Laboratories
Illinois Testing Laboratories, Inc.
INDUSTRIAL PHYSICS & ELECTRONICS CO.
Isotope Products Inc., Instrument Div.
Jordan Corp.
Leupold & Stevens Instruments, Inc.
Lonergan Co., J. E.
Lunkenheimer Co.
Meriam Instrument Co.
MINNEAPOLIS-HONEYWELL REGULATOR CO. BROWN INSTRUMENT DIV.
MINNEAPOLIS-HONEYWELL REGULATOR CO. INDUSTRIAL DIV.
New Jersey Meter Co.
Norden-Ketay Corp.
Nuclear Research Corp.
Powell Co., Wm.
Precision Thermometer & Instrument Co.
Republic Flow Meters Co.
Revere Corp. of America
Rockwell Mfg. Co., Tulsa Div.
ROOTS-CONNERSVILLE BLOWER DIV. DRESSER INDUSTRIES, INC.
Schroeder Brothers Corp.
Southwestern Industrial Electronics Co.
Texas Instruments, Inc. Industrial Instrumentation Div.
Uehling Instrument Co.
U. S. Gauge Div. American Machine & Metals, Inc.
Weston Instruments, Div. Daystrom, Inc.
Wheelco Instr. Div., Barber-Colman Co.

414A METERS & GAGES, HARDNESS TESTING

Industrial Overlay Metals, Inc.

415 METERS & GAGES, ETC., LINEAR MEASURE (CALIPERS, MICROMETERS, ET AL)

Industrial Overlay Metals, Inc.
Lufkin Rule Co.
MINNEAPOLIS-HONEYWELL REGULATOR CO. BROWN INSTRUMENT DIV.
Nuclear Research Corp.
Snap-on-Tools Corp.
Texas Instruments, Inc. Industrial Instrumentation Div.
Tracerlab, Inc.

Uehling Instrument Co.
Western Instruments, Div. Daystrom, Inc.

416 METERS & GAGES, ETC., LIQUID (& SLURRY) DENSITY

Bailey Meter Co.
Beckman Instruments, Inc. Berkeley Div.
Binks Mfg. Co.
Bristol Co.
CURTISS-WRIGHT CORP., ELECTRONICS DIV.
Fischer & Porter Co.
Foxboro Co.
GENERAL ELECTRIC CO. APPARATUS SALES DIV.
Hagan Chemicals & Controls, Inc. Divisions: Calgon Co., Hall Laboratories
H-B Instruments Co., Inc.
INDUSTRIAL PHYSICS & ELECTRONICS CO.
Isotope Products, Inc. Instrument Div.
Macbeth Daylighting Corp.
MINE & SMELTER SUPPLY CO. MARCY MILL DIV.
MINNEAPOLIS-HONEYWELL REGULATOR CO.
Nuclear Research Corp.
Philips Electronics, Inc., Instruments Div.
Precision Thermometer & Instrument Co.
ROOTS-CONNERSVILLE BLOWER DIV. DRESSER INDUSTRIES, INC.
Texas Instruments, Inc. Industrial Instrumentation Div.
Tracerlab, Inc.
Uehling Instrument Co.

417 METERS & GAGES, ETC., SPEED (TACHOMETER, ET AL)

Auto-Lite Battery Corp.
Bailey Meter Co.
Beckman Instruments, Inc. Berkeley Div.
Bristol Co.
Chatillon & Sons, John
Electro Products Laboratories
Esterline-Angus Co., Inc.
Foxboro Co.
GENERAL ELECTRIC CO. APPARATUS SALES DIV.
Ideal Industries, Inc.
Metron Instrument Co.
MINNEAPOLIS-HONEYWELL REGULATOR CO. INDUSTRIAL DIV.
Norden-Ketay Corp.
Reliance Electric & Engineering Co.
STEWART-WARNER CORP. ALEMITE DIV.
Texas Instruments, Inc. Industrial Instrumentation Div.
WESTINGHOUSE ELECTRIC CORP.
Weston Instruments, Div. Daystrom, Inc.
Wheelco Instr. Div., Barber-Colman Co.

418 METERS & GAGES, ETC., TEMPERATURE (THERMOMETERS, PYROMETERS, ETC.)

American Instrument Co., Inc.
Assembly Products, Inc.
Auto-Lite Battery Corp.
Bailey Meter Co.
Blue M Electric Co.
Bristol Co.
Central Scientific Co.
Charles Engelhard, Inc.
Eisler Engineering Co.
Fischer & Porter Co.
Fisher Scientific Co.
Foxboro Co.
GENERAL ELECTRIC CO. APPARATUS SALES DIV.
Gray Instrument Co.
H-B Instrument Co., Inc.
Hagan Chemicals & Controls, Inc. Divisions: Calgon Co., Hall Laboratories
Illinois Testing Laboratories, Inc.
INDUSTRIAL PHYSICS & ELECTRONICS CO.
Leeds & Northrup Co.
MINNEAPOLIS-HONEYWELL REGULATOR CO. INDUSTRIAL DIV. DIV.
MINNEAPOLIS-HONEYWELL REGULATOR CO. INDUSTRIAL DIV.
Precision Thermometer & Instrument Co.
Republic Flow Meters Co.
Texas Instruments, Inc. Industrial Instrumentation Div.
U. S. Gauge Div., American Machine & Metal, Inc.
WESTINGHOUSE ELECTRIC CORP.
Weston Instruments, Div. Daystrom, Inc.
Wheelco Instr. Div. Barber-Colman Co.

419 METERS & GAGES, ETC., TIME (CLOCKS, ETC.)

Bristol Co.
Esterline-Angus Co., Inc.
GENERAL ELECTRIC CO. APPARATUS SALES DIV.
Rockwell Mfg. Co., Tulsa Div.
Sangamo Electric Co.
Texas Instruments, Inc. Industrial Instrumentation Div.

420 MILLS, GRINDING AUTOGENOUS

Aerofall Mills, Inc.
Bico, Inc.
HARDINGE CO., INC.
Majac Inc.
Mead Mill Co.
Pulva Corp.
STURTEVANT MILL CO.
Williams Patent Crusher & Pulverizer Co.

421 MILLS, GRINDING, BALL, PEBBLE, ROD & TUBE

Abbé Engineering Co.
ALLIS-CHALMERS MFG. CO.
American Pulverizer Co.
BABCOCK & WILCOX CO.
Black's Machine Shop
Booth Co.
Combustion Engineering Inc.
Coors Porcelain Co.
DIESEL ENERGY CO.
Denver Equipment Co.
DRAVO CORP.
Eastern Electro-Casting Co., Ltd.
EIMCO CORP.
Fisher Scientific Co.
Foster Wheeler Corp.
Galigher Co.
HARDINGE CO., INC.
Hirsch Bros. Machy. Co.
KENNEDY-VAN SAUN MFG. & ENG. CORP.
MINE & SMELTER SUPPLY CO., MFG. DIV.
Morse Bros. Machinery Co.
NORDBERG MFG. CO.
Patterson Foundry & Machine Co.
SHEFFIELD DIV. ARMCO STEEL CORP.
SMIDTH & CO., F. L.
STEARNS ROGER MFG. CO.
STRAUB MFG. CO.
TRAYLOR ENGINEERING & MFG. CO.
VULCAN IRON WORKS CO. (VULCAN—DENVER)

422 MILLS, MOBILE UNIT (COMPLETE ORE DRESSING)—does not include Crushers, Mobile Units alone

Carpco Manufacturing, Inc.
Denver Equipment Co.
Kenyon Walker Machinery Co.
WEMCO, DIV. WESTERN MACHINERY CO.

(MILLS, PUG—see Scrubbers)

423 MILL BALLS & SIMILAR MEDIA, GRINDING

Abbé Engineering Co.
ALLIS-CHALMERS MFG. CO.
American Forge Co.
BABCOCK & WILCOX CO.
Calumet Div. Calumet & Hecla, Inc.
COATES STEEL PRODUCTS CO.
Couer d'Alene Hardware & Foundry Co.
COLORADO FUEL & IRON CORP.
Coors Porcelain Co.
Denver Equipment Co.
Endicott Forging & Mfg. Co.
Foster Wheeler Corp.
HARDINGE CO., INC.
KENNEDY-VAN SAUN MFG & ENG. CORP.
MINE & SMELTER SUPPLY CO. MANUFACTURING DIV.
NATIONAL MALLEABLE & STEEL CASTINGS CO.
Patterson Foundry & Machine Co.
Porcelain Div., Ferro Corp.
Sheffield Div. Armco Steel Corp.
TENNESSEE COAL & IRON DIV. U. S. STEEL CORP.
U. S. STEEL CORP. COLUMBIA-GENEVA STEEL DIV.
Vanadium-Alloys Steel Co.

424 MILL LINERS, GRINDING

Abbé Engineering Co.
ALLIS-CHALMERS MFG. CO.
AMERICAN BRAKE SHOE CO. AMERICAN MANGANESE STEEL DIV.
BALDWIN-LIMA-HAMILTON CORP. STANDARD STEEL WORKS DIV.
Calumet Div. Calumet & Hecla, Inc.
Columbia Steel Casting Co., Inc.
Coors Porcelain Co.
Coeur d'Alene Hardware & Foundry Co.
Dagley Mfg. Co.
Denver Equipment Co.
EIMCO CORP.
HARDINGE CO., INC.
Hirsch Bros. Machy. Co.
Kensington Steel Div., Poor & Co.
LINATEX CORP. OF AMERICA
Los Angeles Steel Casting Co.
MINE & SMELTER SUPPLY CO., MANUFACTURING DIV.
NATIONAL MALLEABLE & STEEL CASTINGS CO.
NORDBERG MFG. CO.
Patterson Foundry & Machine Co.
Porcelain Div., Ferro Corp.
Sorel Steel Foundries, Ltd.
STEARNS ROGER MFG. CO.
TENNESSEE COAL & IRON DIV. U. S. STEL CORP.
Thomas Foundries, Inc.
U. S. STEEL CORP. COLUMBIA-GENEVA STEEL DIV.
YUBA CONSOLIDATED INDUSTRIES, INC.

425 MILL RODS, GRINDING

Abbé Engineering Co.
ALLIS-CHALMERS MFG. CO.
American Forge Co.
COLORADO FUEL & IRON CORP.
Denver Equipment Co.
Dominion Steel & Coal Corp., Ltd.
HARDINGE CO., INC.
KENNEDY-VAN SAUN MFG. & ENG. CORP.
MINE & SMELTER SUPPLY CO., MANUFACTURING DIV.
Patterson Foundry & Machine Co., Div. Ferro Corp.
SHEFFIELD DIV. ARMCO STEEL CORP.
TENNESSEE COAL & IRON DIV. U. S. STEEL CORP.
U. S. STEEL CORP. COLUMBIA-GENEVA STEEL DIV.

426 MILL SHELLS, GRINDING

Abbé Engineering Co.
ALLIS-CHALMERS MFG. CO.
BALDWIN-LIMA-HAMILTON CORP. STANDARD STEEL WORKS DIV
Denver Equipment Co
HARDINGE CO., INC.
KENNEDY-VAN SAUN MFG. & ENG. CORP.
MINE & SMELTER SUPPLY CO., Manufacturing Div.
NORDBERG MFG. CO.
Patterson Foundry & Machine Co., Div. Ferro Corp.
SMIDTH & CO., F. L.
STEARNS ROGER MFG. CO.
TRAYLOR ENGINEERING & MFG CO.

(MINE CARS — see Cars, Mine)

427 MINE DOORS (including Automatic Pressure, Safety, Watertight, etc.)

AMERICAN MINE DOOR CO.
Couer d'Alene Hardware & Foundry Co.
Sun Shipbuilding & Dry Dock Co.

(MINE SUPPORTS — see below; also see: Steel; Rock Bolts; Fencing, Metal Wire)

428 MINE SUPPORTS, METAL, SETS & ARCH PLATES

BETHLEHEM STEEL CO., INC.
Commercial Shearing & Stamping Co. Dept. EMJ-MG
Dominion Steel & Coal Corp., Ltd.
Herold Mfg. Co.
Irwin-Sensenich Corp.
Rockiron Co., Ltd.
Sutton Steele & Steele, Inc.

429 MINE SUPPORTS, METAL, YIELDABLE SETS & ARCHES

Bethlehem Pacific Coast Steel Corp.
BETHLEHEM STEEL CO., INC.
Irwin-Sensenich Corp.

430 MINE SUPPORTS, METAL — PROPS (including reusable, movable & yieldable types)

Coeur d'Alene Hardware & Foundry Co.
Douety Mining Equipment Ltd.
Duff Norton Co.
Herold Manufacturing Co.
Irwin-Sensenich Corp.
Templeton, Kenly & Co.

431 MINERAL DEALERS & SALES AGENTS

American Metal Co.
Associated Metals & Minerals Corp.
AMERICAN SMELTING & REFINING CO.
Calabrian Co., Inc.
Charles Engelhard, Inc.
Continental Mineral Processing Co.
Continental Ore Corp.
DeSousa Co., Inc., J. E.
GODOY & CO., INC., E. A.
Grace & Co., W. R.
Handy & Harman
INTERNATIONAL BARTERING CO.
INTERNATIONAL MINERALS & METALS CORP.
Metal & Thermit Corp.
Metal Traders Inc.
Minerals Engineering Co.
New Jersey Zinc Co.
Overseas Raw Materials Corp.
Philipp Bros., Inc.
Pitkin, Inc., Lucius
Tennant Sons & Co., C. of N. Y.
Ultra-Violet Products, Inc.
U. S. Smelting, Refining & Mining Co. Inc.
Vale Do Rio Doce Trading Co., Inc.
Wah Chang Corp.

431A MINERAL SPECIMENS

Scott Williams Mineral Co.
Ward's Natural Science Establishment, Inc.

432 MINERAL SPECIMEN PREPARATION (THIN SECTS., ETC.)

Cal-Brea
Organist Petrographic Laboratory, D. M.

(MIXERS—see Agitators)

433 MONITOR, HYDRAULIC (WATER)

(MOTORS—see: Air Motors; Electric Motors; Hydraulic Motors)

(MUCKING MACHINES—see Loaders)

N

434 NODULIZING EQUIPMENT — also see; Sintering Equipment; Pelletizing Equip.; Briquetting Equip.

DRAVO CORP.
Dwight-Lloyd Div. McDowell Co., Inc.
GOULD CO., GORDON I.
HARDINGE CO., INC.
KENNEDY-VAN SAUN MFG. & ENG. CORP.
LINK-BELT CO.
McDowell Co., Inc.
Wellman Engineering Co. McDowell Enterprise

435 NOZZLES—does not include Monitors, Hydraulic

Bete Fog Nozzle, Inc.

Binks Mfg. Co.
Booth Co.
Branford Co.
Chain Belt Co.
DEISTER CONCENTRATOR CO.
Deister Machine Co.
Elkhart Brass Mfg. Co., Inc.
Gray Co., Inc.
Johnson-March Corp.
Jordan Corp.
LINK-BELT CO.
Norton Co.
Pangborn Corp.
Penberthy Mfg. Co.
Pettinos, Inc., George F.
Prehy Co.
SPRAYING SYSTEMS CO.
U. S. RUBBER CO.
Yarnall-Waring Co.
YUBA CONSOLIDATED INDUSTRIES, INC., YUBA MINING DIV.

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436 OFFICE MACHINES & EQUIPMENT—does not include: Computing Machines; Drafting Equip.

Automatic Electric Co.
Bruning Co., Inc. Charles
Ozalid Div. General Aniline & Film Corp.
Peerless Photo Products, Inc.
Remington Rand Div. Sperry Rand Corp.
REPUBLIC STEEL CORP.
Taller & Cooper, Inc.

(ORE, DEALERS—See Mineral Dealers and Sales Agents)

P

437 PACKING

Acme Rubber Mfg. Co.
Belmont Packing & Rubber Co.
Boston Woven Hose & Rubber Co.
Chemical & Power Products, Inc.
Duriron Co., Inc.
Felt Products Mfg. Co.
Garlock Packing Co.
Gatke Corp.
Goodall Rubber Co.
GOODRICH INDUSTRIAL PRODUCTS CO., B. F.
GOODYEAR TIRE & RUBBER CO.
Graton & Knight Co.
Greene, Tweed & Co.
HAMILTON RUBBER MFG. CORP.
HEWITT-ROBINS, INC.
Houghton & Co., E. F.
Johns-Manville
Keasbey & Mattison Co.
New York Belting & Packing Co.
Philadelphia Belting Co.
H. K. PORTER COMPANY, INC., THERMOID DIV.
RAYBESTOS-MANHATTAN, INC. MANHATAN RUBBER DIV.
Republic Rubber Div. Lee Rubber & Tire Corp.
Rhoads & Son, J. E.
Snyder & Son, Inc., M. L.
Union Asbestos & Rubber Co.
U. S. RUBBER CO. MECHANICAL GOODS DIV.
Westinghouse Air Brake Co. Ind. Products Div.

438 PAINTS—also see Coatings

Aluminum Co. of America
AMERCOAT CORP.
Cabot, Inc., Samuel
Canadian Industries Ltd.
Carboline Co.
Carbolineum Wood Preserving Co.
Carey Mfg. Co., Philip
Dixon Crucible Co., Joseph
DuPont de Nemours & Co., E. I.
Koppers Co. Inc.
Master Bronze Powder Co., Inc.
Metal & Thermit Corp.
National Lead Co.
Pennsalt Chemicals Corp.
Quigley Co., Inc.
Reilly Tar & Chemical Corp.
Ruberoid Co.
Rust-Oleum Corp.
Sherwin-Williams Co.
STANDARD OIL CO. OF CALIF., WESTERN OPERATIONS, INC.
WESTINGHOUSE ELECTRIC CORP.
Wilbur & Williams Co.

439 PELLETIZING-BALLING EQUIPMENT—does not include: Sintering Equip.; Nodulizing Equip.; Briquetting Equip.

DRAVO CORP.
HARDINGE CO., INC.
McDowell Co., Inc.
NORDBERG MFG. CO.

440 PETROLEUM PRODUCTS also see Lubricants

Arkansas Fuel Oil Corp.
Atlantic Refining Co.
Brooks Oil Co.
Cities Service Oil Co.
Gulf Oil Corp.
Houghton & Co., E. F.
Jet-Lube, Inc.
New York & New Jersey Lubricant Co.
Phillips Petroleum Co.
Pure Oil Co.
Shell Oil Co.
Sinclair Refining Co.
STANDARD OIL CO., OF CALIFORNIA WESTERN OPERATIONS, INC.
Standard Oil Co.—Indiana
Sun Oil Co.
TEXAS CO.
Valvoline Oil Co., Div. Ashland Oil & Refining Co.

(pH INDICATORS — see Meters, Chemical)

(PHOTOCOPY EQUIPMENT see Blueprint Machines)

(PICKS — see: Geologist's Equipment; Tools)

(PIPE & TUBING—see below; also see Electrical Conduit)

440A PIPE, ASBESTOS & CEMENT

Johns-Manville
Keasbey & Mattison Co.

441 PIPE, IRON & STEEL

Alco Products, Inc.
Allegheny Ludlum Steel Corp.
Armco Drainage & Metal Products, Inc.
ATLAS COPCO PACIFFIC, INC.
Atlas Steels, Ltd.
BABCOCK & WILCOX CO.
Beall Pipe & Tank Corp.
Bethlehem Pacific Coast Steel Corp.
BETHLEHEM STEEL CO., INC.
BLAW-KNOX CO. POWER PIPING & SPRINKLER DIV.
Byers Co., A. M.
Carpenter Steel Co.
COLORADO FUEL & IRON CORP.
CRANE CO.
CRUCIBLE STEEL CO. OF AMERICA
Dominion Steel & Coal Corp., Ltd.
Dominion Steel & Coal Corp., Ltd.
Electric Steel Foundry Co.
Foster Co., L. B.
Goyne Pump Co.
Graybar Elec. Co., Inc.
JONES & LAUGHLIN STEEL CORP.
Kaiser Steel Corp.
KELLOG CO., M. W.
NATIONAL SUPPLY CO.
NAYLOR PIPE CO.
Ogden Iron Works
Pittsburgh Steel Co.
Republic Steel Corp.
Ryerson & Son, Inc., Joseph T.
Swepco Tube Corp.
U. S. Pipe & Foundry Co.
U. S. STEEL CORP. COLUMBIA-GENEVA STEEL DIV.
U. S. STEEL CORP. NATIONAL TUBE DIV.
Wheeling Steel Corp.
WICKWIRE SPENCER STEEL DIV. COLORADO FUEL & IRON CORP.
Youngstown Sheet & Tube Co.
YUBA CONSOLIDATED INDUSTRIES, INC., SOUTHWEST WELDING & MANUFACTURING DIV.

442 PIPE, NON-FERROUS METAL

Aluminum Co. of America
American Brass Co.
AMERICAN SMELTING & REFINING CO. FEDERATED METALS DIV.
Ampco Metal, Inc.
Bunker Hill Co.
CRUCIBLE STEEL CO. OF AMERICA
Foster Co., L. B.
Goyne Pump Co.
Graybar Elec. Co., Inc.
Haynes Stellite Co. Div. Union Carbide Corp.
INTERNATIONAL NICKEL CO.
Kaiser Aluminum & Chemical Sales, Inc.
Mueller Brass Co.
National Lead Co.
PHELPS DODGE COPPER PRODUCTS CORP.
Revere Copper & Brass, Inc.
Reynolds Metals Co.
Ryerson & Son, Inc., Joseph T.
Swepco Tube Corp.
Triangle Conduit & Cable Co., Inc.

443 PIPE (METAL), NON-METALLIC LINED

American Hard Rubber Co.
DOW CHEMICAL CO.
Galigher Co.
Goodall Rubber Co.
GOODRICH INDUSTRIAL PRODUCTS CO., B. F.
Graybar Elec. Co., Inc.
LINATEX CORP. OF AMERICA
Luzerne Rubber Co.
U. S. Pipe & Foundry Co.

444 PIPE, PLASTIC

AMERCOAT CORP.
American Hard Rubber Co.
Anchor Plastics Co. Inc.
Byers Co., A. M.
Carlon Products Corp.
Continental-Diamond Fibre Corp., Subsidiary Budd Co.
CRANE CO.
DOW CHEMICAL CO.
Electric Steel Foundry Co.
Evanite Plastic Co., Div. Evans Pipe Co.
Formica Corp. Subsidiary of Cyanamid
Foster Co., L. B.
Franklin Plastics Co.
Gering Products, Inc.
Goodall Rubber Co.
GOODRICH INDUSTRIAL PRODUCTS CO., B. F.
GOODYEAR TIRE & RUBBER CO.
Graybar Elec. Co., Inc.
Grinnell Co., Inc.
Irvington Div. Minnesota Mining & Mfg. Co.
Johnson Plastic Corp.
Kraloy Plastic Pipe Co., Inc.
Line Materials Industries
Luzerne Rubber Co.
Mueller Brass Co.
Plastex Co.
PORTER COMPANY, INC., H. K., THERMOID DIV.
REPUBLIC STEEL CORP.
Ryerson & Son, Inc., Joseph T.
Synthane Corp.
Triangle Conduit & Cable Co., Inc.
U. S. RUBBER CO.
U. S. RUBBER CO. MECHANICAL GOODS DIV.
U. S. STEEL CORP. COLUMBIA-GENEVA STEEL DIV.
U. S. STEEL CORP. NATIONAL TUBE DIV.
Youngstown Sheet & Tube Co.

445 PIPE, VENTILATION — does not include Ventilation Tubing, Non-Metallic

Armco Drainage & Metal Products, Inc.
Carrier Corp.
Coeur d'Alene Hardware & Foundry Co.
Kirk & Blum Mfg. Co.
Kraloy Plastic Pipe Co., Inc.
MACHINERY CENTER, INC.
NAYLOR PIPE CO.
Swepco Tube Corp.
Triangle Conduit & Cable Co., Inc.

446 PIPE, WOOD

Acme Tank Mfg. Co.
Arrow Tank Co.
Atlantic Tank Corp.
Caldwell Co., W. E.
Hauser-Stander Tank Co.
Michigan Pipe Co.
National Tank & Pipe Co.
Pacific Wood Tank Corp.
Santa Fe Tank Div. Fluor Products Co.
Sutphen, Peter O.
Windeler Co., Ltd., George

447 PIPE FITTINGS — also see: Pipe Line Traps; Nozzles; Valves

Alco Products, Inc.
Aluminum Co. of America
American Hard Rubber Co.
American Instrument Co., Inc.
Ampco Metal, Inc.
Arrowhead Products, Div. Federal-Mogul-Bower Bearings, Inc.
Appleton Electric Co.
ATLAS COPCO PACIFIC, INC.
Band-It Co.
BLAW-KNOX CO. POWER PIPING & SPRINKLER DIV.
Chase Brass & Copper Co.
CRANE CO.
CRUCIBLE STEEL CO. OF AMERICA
DOW CHEMICAL CO.
Dresser Mfg. Div. Dresser Industries, Inc.
Duriron Co., Inc.
Electric Steel Foundry Co.
Erie Pump & Engine Works
Evanite Plastic Co., Div. Evans Pipe Co.
Fairbanks Co.
Foster Co., L. B.
Franklin Plastics Co.
GOODRICH INDUSTRIAL PRODUCTS CO., B. F.
Goyne Pump Co.
Grinnel Co., Inc.
Gustin-Bacon Mfg. Co.
Haynes Stellite Co. Div. Union Carbide Corp.
INTERNATIONAL NICKEL CO.
Jefferson Union Co.
Johnson Plastic Corp.
Jordan Corp.
Kraloy Plastic Pipe Co., Inc.
Ladish Co.
Los Angeles Steel Casting Co.
Luzerne Rubber Co.
Manning Co., Charles E.
McDowell Mfg. Co.
Meckum Engineering, Inc.
Mission Mfg. Co.
Mueller Brass Co.
NAYLOR PIPE CO.
Plastex Co.
Plumbing Products Div., Zurn Industries, Inc.
Stockham Valves & Fittings
Swepco Tube Corp.
Triangle Conduit & Cable Co., Inc.
Tube Turns Div., Chemetron Corp.
Tube Turns Plastics, Inc.
U. S. RUBBER CO.
U. S. RUBBER CO. MECHANICAL GOODS DIV.
VICTAULIC CO. OF AMERICA
Walworth Co.
Weatherhead Co. Fort Wayne Div.

448 PIPELINE TRAPS, AIR, STEAM & WATER

CRANE CO.
New Jersey Meter Co.
Yarnall-Waring Co.

(PNEUMATIC—see Air)

(POWER PLANTS—see Electric Generating Power Plants)

(POWER SHOVELS — see Excavators)

449 POWER TAKE-OFFS — also see Drives

American Standard Industrial Div.
Davey Compressor Co.
Drilling Accessory & Mfg. Co., Inc.
Eaton Manufacturing Co.
Failing Co., George E.
Gar Wood Industries, Inc.
Hayes Steel Products, Ltd.
Hendrickson Mfg. Co.
MAYHEW MACHINE & SUPPLY Co.
Minerals Engineering Co.
Morse Chain Co.
Rockwell Spring & Axle Co. Timken-Detroit Axle Div.
Stimmel Winch Co., Inc.
Twin Disc Clutch Co.
Western Gear Corp.

(PROFESSIONAL SERVICES—see: Consultants; Contractors; Laboratory Service)

(PROTECTIVE CLOTHING — see Safety Clothing)

(PUG MILLS—see Scrubbers)

(PULLEYS—see Blocks)

(PULLEYS, MAGNETIC—see Separators, Magnetic)

450 PULVERIZERS — also see: Crushers; Mills, Grinding

Abbé Engineering Co.
Acme Road Machinery Co., Inc.
ALLIS-CHALMERS MFG. CO.
American Pulverizer Co.
BABCOCK & WILCOX CO.
Bartlett & Snow Co., C. O.
Bico, Inc.
Bradley Pulverizer Co.
Buffalo Hammer Mill Corp.
Combustion Engineering, Inc. Raymond Div.
Denver Equipment Co.
Denver Fire Clay Co.
DIESEL ENERGY CORP.
Foster Wheeler Corp.
Gruender Crusher & Pulverizer Co.
HARDINGE CO., INC.
IOWA MFG. CO.
JEFFREY MFG. CO.
Lippmann Engineering Works, Inc.
MACHINERY CENTER INC.
Majac Inc.
Mead Mill Co.
MINE & SMELTER SUPPLY CO., MFG. DIV.
Morse Bros. Machinery Co.
Norma-Hoffman Bearings Corp.
Patterson Foundry & Machine Co., Div. Ferro Corp.
Pioneer Engineering Div., Poor & Co., Inc.
Pulva Corp.
Pulverizing Machinery Div., Metals Disintegrating Co., Inc.
Rogers Iron Works Co.
SMIDTH & CO., F. L.
STURTEVANT MILL CO.
Whiting Corp.
Williams Patent Crusher & Pulverizer Co.

451 PUMPS, AIR DRIVEN

Aldrich Pump Co.
American-Marsh Pumps, Inc.
ATLAS COPCO PACIFIC, INC.
Binks Mfg. Co.
BOYLES BROS. DRILLING CO., LTD.
Byron Jackson Pumps, Inc., Subsidiary Borg-Warner Corp.
CHICAGO PNEUMATIC TOOL CO.
Cleco Div., Reed Roller Bit Co.
Davidson Co., M. T.
DORR OLIVER, INC.
GARDNER-DENVER CO.
Gray Co., Inc.
Hayes Steel Products, Ltd.
Herold Mfg. Co.
Hills-McCanna Co.
LAWRENCE PUMPS, INC.
LE ROI DIV. WESTINGHOUSE AIR BRAKE CO.
Lincoln Engineering Co., Div. McNeil Machine & Engineering Co.
Longyear Co., E. J.
McGowan Pump Div., Leyman Mfg. Corp.
Schramm, Inc.
Warren Pumps, Inc.
Worthington Corp.

452 PUMPS, AIR LIFT

CHICAGO PNEUMATIC TOOL CO.
Condenser Service & Engineering Co.
GARDNER-DENVER CO.
INGERSOLL-RAND CO.
Nash Engineering Co.
Worthington Corp.

453 PUMPS, CENTRIFUGAL & TURBINE

ALLEN-SHERMAN-HOFF PUMP CO.
ALLIS-CHALMERS MFG. CO.
American Crucible Products, Inc., Kenco Pump Div.
American-Marsh Pumps, Inc.
American Well Works
Ampco Metal, Inc.
Aurora Pump Div., New York Air Brake Co.
Barrett Haentjens & Co.
Buffalo Forge Co.
Byron Jackson Pumps, Inc., Subsidiary Borg-Warner Corp.
Carver Pump Co.
Chain Belt Co.
Construction Machinery Co.
Davidson Co., M. T.
DeLaval Steam Turbine Co.
Deming Co.
DORR OLIVER, INC.
Duriron Co., Inc.
Erie Pump & Engine Works
Essick Mfg. Co.
FAIRBANKS, MORSE & CO.
Flood City Brass & Elec. Co.
GARDNER-DENVER CO.
Gorman-Rupp Co.
Goulds Pumps, Inc.
Goyne Pump Co.
Homelite Div., Textron Inc.
INGERSOLL-RAND CO.
Jacuzzi Bros., Inc.
Jaeger Machine Co.
Johnston Pump Co.
Krogh Pump & Equipment Co., Inc.
LAWRENCE PUMPS, INC.
Layne & Bowler Pump Co. of Los Angeles.
Lecourtenay Co.
McDonald Mfg. Co., A. Y.
McGowan Pump Div., Leyman Mfg. Corp.
MORRIS MACHINE WORKS
McNALLY PITTSBURG MFG. CORP.
MISSION MFG. CO.
Morse Bros. Machinery Co.
National Carbon Co. Union Carbide Corp.
New York Air Brake Co. Aurora Pump Div.
Novo Pump & Engine Co.
Peerless Pump Div. Food Machinery & Chemical Corp.
Pennsylvania Drilling Co.
Pennsylvania Pump & Compressor Co.
Rice Pump & Machine Co.
Schneible Co., Claude B.
Stanco Mfgs. & Sales, Inc.
Standard Elec. Mfg. Co., Inc.
Swaby Mfg. Co.
Warren Pumps, Inc.
WEMCO, DIV. WESTERN MACHINERY CO.
Weinman Pump Mfg. Co.
Wheeler Mfg. Co., C. H., Economy Pump Div.
WILFLEY & SONS, A. R.
Wintroath Pumps Div., Worthington Corp.

(PUMPS, CONCRETE & REFRACTORY—see: Concrete; Refractories)

454 PUMPS, CORROSIVE LIQUIDS

Aldrich Pump Co.
ALLEN-SHERMAN-HOFF PUMP CO.
ALLIS-CHALMERS MFG. CO.
American Hard Rubber Co.
American Instrument Co., Inc.
American-Marsh Pumps, Inc.
Ampco Metal, Inc.
Barrett Haentjens & Co.
Binks Mfg. Co.
Brosites Products Corp.
Buffalo Forge Co.
Byron Jackson Pumps, Inc., Subsidiary Borg-Warner Corp.
Canadian Locomotive Co., Ltd.
CHICAGO PNEUMATIC TOOL CO.
Denver Equipment Co.
DORR, OLIVER, INC.
Duriron Co., Inc.
Flood City Brass & Elec. Co.
Galigher Co.
GARDNER-DENVER CO.
Goulds Pumps, Inc.
Goyne Pump Co.
Gray Co., Inc.
Hills-McCanna Co.
Hypro Engineering, Inc.
INGERSOLL-RAND CO.
Jacuzzi Bros., Inc.
Johnston Pump Co.
Krogh Pump & Equipment Co., Inc.
LAWRENCE PUMPS, INC.
Lecourtenay Co.
LINATEX CORP. OF AMERICA
Lincoln Engineering Co. Div. McNeil Machine & Engineering Co.
Luzerne Rubber Co.
Manzel Div., Houdaille Industries, Inc.
McGowan Pump Div., Leyman Mfg. Corp.
NAGLE PUMPS, INC.
National Carbon Co. Union Carbide Corp.
National Lead Co.
New York Air Brake Co. Aurora Pump Div.
Peerless Pump Div. Food Machinery & Chemical Corp.
Penberthy Mfg. Co.
Pennsylvania Pump & Compressor Co.
Shriver & Co., T.
Warren Pumps, Inc.
Weinman Pump Mfg. Co.
WEMCO DIV. WESTERN MAHINERY
WESTINGHOUSE ELECTRIC CORP.
Wintroath Pumps Div. Worthington Corp.
WILFLEY & SONS, A. R.

455 PUMPS, DEEP WELL — also see Pumps, Submersible

American Well Works
Barnes Mfg. Co.
Byron Jackson Pumps, Inc., Subsidiary Borg-Warner Corp.
Deming Co.
FAIRBANKS, MORSE & CO.
Food Machinery & Chemical Corp. Peerless Pump Div.
INGERSOLL-RAND CO.
Jacuzzi Bros. Inc.
Johnston Pump Co.
Kobe, Inc.
Layne & Bowler Pump Co. of Los Angeles
McDonald Mfg. Co. A. Y.
New York Air Brake Co. Aurora Pump
Pennsylvania Drilling Co.
Robbins & Myers Inc. Moyno Pump Div.
WEMCO DIV. WESTERN MACHINERY
Wintroath Pumps Div. Worthington Corp.
Worthington Corp.

456 PUMPS, DIAPHRAGM

American Instrument Co., Inc.
Barnes Mfg. Co.
Brosites Products Corp.
Carver Pump Co.
Chain Belt Co.
Construction Machy. Co.
Dagley Mfg. Co.
Denver Equipment Co.
DORR OLIVER, INC.
Essick Manufacturing Co.
Gorman-Rupp Co.
HARDINGE CO., INC.
Hills-McCanna Co.
Homelite Div., Textron Inc.
Hypro Engineering, Inc.
Jaeger Machine Co.
Manzel Div., Houdaille Industries, Inc.
Marlow Pumps Div. Bell & Gosset Co.
McGowan Pump Div. Leyman Mfg. Corp.
Morse Bros. Machinery Co.
Novo Pump & Engine Co.
Philadelphia Belting Co.
Rice Pump & Machine Co.
Shriver & Co., T.
WEMCO, DIV. WESTERN MACHINERY CO.
Worthington Corp.

457 PUMPS, DREDGE & GRAVEL — also see Pumps, Sand & Slime

ALLEN-SHERMAN-HOFF PUMP CO.
ALLIS-CHALMERS MFG. CO.
AMERICAN BRAKE SHOE CO. AMERICAN MANGANESE STEEL DIV.
AMERICAN BRAKE SHOE CO.
AMERICAN HOIST & DERRICK CO.
Carver Pump Co.
CHICAGO PNEUMATIC TOOL CO.
ELLICOTT MACHINE CORP.
Erie Pump & Engine Works
Essick Manufacturing Co.
Georgia Iron Works Co.
INGERSOLL-RAND CO.
Kansas City Hay Press
Krogh Pump & Equipment Co., Inc.
LAWRENCE PUMPS, INC.
Meckum Engineering, Inc.
MORRIS MACHINE WORKS
NAGLE PUMPS, INC.
Pettibone Mulliken Corp.
Sutton Steele & Steele, Inc.
Thomas Foundries, Inc.
WILFLEY & SONS, A. R.
Worthington Corp.

458 PUMPS, HYDRAULIC FLUID

Aldrich Pump Co.
American Instrument Co., Inc.
Anthony Co.
Commercial Shearing & Stamping Co.
Davidson Co., M. T.
DeLaval Steam Turbine Co.
Hales Co., W. M.
Houghton & Co., E. F.
INGERSOLL-RAND CO.
Johnston Pump Co.
Kobe, Inc.
Krogh Pump & Equipment Co., Inc.
Ledeen, Inc.
Lincoln Engineering Co. Div. McNeil Machine & Engineering Co.
New York Air Brake Co. Aurora Pump Div.
Oilgear Co.
Owatonna Tool Co.
Penberthy Mfg. Co.
Pennsylvania Pump & Compressor Co.
Star Jack Co.
Templeton, Kenly & Co.
Vickers Inc.
Weinman Pump Mfg. Co.
Worthington Corp.

459 PUMPS, HYDRAULIC RAM-TYPE

Blackhawk Mfg. Co.
Ledeen, Inc.
Lincoln Engineering Co. Div. McNeil Machine & Engineering Co.
Moran Engineering Co.
Owatonna Tool Co.
Templeton, Kenly & Co.

460 PUMPS, PISTON & PLUNGER

Aldrich Pump Co.
American Instrument Co., Inc.
American-Marsh Pumps, Inc.
BOYLES BROS. DRILLING CO., LTD.
Davidson Co., M. T.
Deming Co.
DORR OLIVER, INC.
Eastman-Pacific Co.
Flood City Brass & Elec Co.
GARDNER-DENVER CO.
Hills-McCanna Co.
Hypro Engineering, Inc.
Kobe, Inc.
Ledeen, Inc.
Lincoln Engineering Co. Div. McNeil Machine & Engineering Co.
Manzel Div., Houdaille Industries, Inc.
Marlow Pumps Div. Bell & Gossett Co.
McDonald Mfg. Co., A. Y.
McGowan Pump Div., Leyman Mfg. Corp.
NATIONAL SUPPLY CO.
Novo Pump & Engine Co.
Oilgear Co.
Oliver Corp. A. B. Farquhar Div.
Pennsylvania Drilling Co.
Samford-Day Iron Works, Inc.
Vickers Inc.
Warren Pumps, Inc.
Worthington Corp.

461 PUMPS, PRIMING

American Crucible Products Co. Kenco Pump Div.
Barrett Haentjens & Co.
Duriron Co., Inc.
Goulds Pumps, Inc.
Hypro Engineering, Inc.
INGERSOLL-RAND CO.
LAWRENCE PUMPS, INC.
Marlow Pumps Div. Bell & Gossett Co.
McGowan Pump Div. Leyman Mfg. Corp.
Nash Engineering Co.
New York Air Brake Co. Aurora Pump Div.
Penberthy Mfg. Co.
Rice Pump & Machine Co.
Worthington Corp.

(PUMPS, RECIPROCATING—see Pumps, Piston)

462 PUMPS, ROTARY DISPLACEMENT

Beach-Russ Co.
CHICAGO PNEUMATIC TOOL CO.
DeLaval Steam Turbine Co.
Deming Co.
FAIRBANKS, MORSE & CO.
Flood City Brass & Electric Co.
Goulds Pumps Inc.
Holman Bros. — Canada Ltd.
Hypro Engineering, Inc.
Nash Engineering Co.
Oilgear Co.
Porto Pump Inc.
Rockwell Mfg. Co., Hydraulics Div.
ROOTS-CONNERSVILLE BLOWER DIV. DRESSER INDUSTRIES, INC.
Vickers Inc.
Warren Pumps, Inc.
Worthington Corp.

463 PUMPS, SAND & SLIME

ALLEN-SHERMAN-HOFF PUMP CO.

ALLIS-CHALMERS MFG. CO.
AMERICAN BRAKE SHOE CO. AMERICAN MANGANESE STEEL DIV.
Barrett Haentjens & Co.
Canadian Locomotive Co., Ltd.
Carpco Manufacturing Inc.
CHICAGO PNEUMATIC TOOL CO.
Dagley Mfg. Co.
Denver Equipment Co.
ELLICOTT MACHINE CORP.
Erie Pump & Engine Works
Galigher Co.
GARDNER-DENVER CO.
Georgia Iron Works Co.
Goyne Pump Co.
Heroid Mfg. Co.
INGERSOLL-RAND CO.
Jaeger Machine Co.
Kansas City Hay Press
Krogh Pump & Equipment Co., Inc.
LAWRENCE PUMPS, INC.
LINATEX CORP. OF AMERICA
McGowan Pump Div. Leyman Mfg. Corp.
Meckum Engineering, Inc.
MORRIS MACHINE WORKS
NAGLE PUMPS, INC.
Pettibone Mulliken Corp.
Prehy Co.
Robbins & Myers, Inc., Moyno Pump Div.
Spang & Co.
Telluride Iron Works Co.
Thomas Foundries, Inc.
Weinman Pump Mfg. Co.
WEMCO, DIV. WESTERN MACHINERY CO.
WILFLEY SONS, A. R.
Worthington Corp.
YUBA CONSOLIDATED INDUSTRIES, INC.

464 PUMPS, SUBMERSIBLE

ALLEN-SHERMAN-HOFF PUMP CO.
American Crucible Products Co., Kenco Pump Div.
Aurora Pump Div., New York Air Brake Co.
Barnes Mfg. Co.
Barrett, Haentjens & Co.
Byron Jackson Pumps, Inc., Subsidiary Borg-Warner Corp.
Carver Pump Co.
CHICAGO PNEUMATIC TOOL CO.
Dean Hill Pump Co.
Deming Co.
FAIRBANKS MORSE & CO.
INGERSOLL-RAND CO.
Jacuzzi Bros., Inc.
Johnston Pump Co.
Layne & Bowler Pump Co. of Los Angeles
McDonald Mfg. Co., A. Y.
New York Air Brake Co. Aurora Pump Div.
Peerless Pump Div. Food Machinery & Chemical Corp.
Penberthy Mfg. Co.
Pennsylvania Drilling Co.
Schramm, Inc.
Stanco Mfgs. & Sales, Inc.
Standard Elec. Mfg. Co., Inc.
Swaby Mfg. Co.
Weinman Pump Mfg. Co.
WEMCO, DIV. WESTERN MACHINERY CO.
Wintroath Pumps Div. Worthington Corp.
Worthington Corp.

465 PUMPS, SUMP

ALLEN-SHERMAN-HOFF PUMP CO.
American Crucible Products Co., Kenco Pump Div.
American-Marsh Pumps, Inc.
ATLAS COPCO EASTERN, INC.
ATLAS COPCO PACIFIC, INC.
Aurora Pump Div., New York Air Brake Co.
Barnes Mfg. Co.
Barrett Haentjens & Co.
Buffalo Forge Co.
Byron Jackson Pumps, Inc., Subsidiary Borg-Warner Corp.
Canadian Locomotive Co., Ltd.
Carver Pump Co.
CHICAGO PNEUMATIC TOOL CO.
Cleco Div., Reed Roller Bit Co.
Davidson Co., M. T.
Dean Hill Pump Co.
Deming Co.
Denver Equipment Co.
Essick Manufacturing Co.
FAIRBANKS, MORSE & CO.
Galigher Co.
GARDNER-DENVER CO.
Gorman Rupp Co.
Goulds Pumps, Inc.
Holman Bros.-Canada Ltd.
Hypro Engineering, Inc.
INGERSOLL-RAND CO.
Jacuzzi Bros., Inc.
Jaeger Machine Co.
Johnston Pump Co.
Krogh Pump & Equipment Co., Inc.
LAWRENCE PUMPS, INC.
Layne & Bowler Pump Co. of Los Angeles
LE ROI DIV. WESTINGHOUSE AIR BRAKE CO.
McDonald Mfg. Co., A. Y.
McGowan Pump Div., Leyman Mfg. Corp.
NAGLE PUMPS, INC.
New York Air Brake Co. Aurora Pump Div.
Peerless Pump Div. Food Machinery & Chemical Corp.
Penberthy Mfg. Co.
Rice Pump & Machine Co.
Robbins & Myers, Inc., Moyno Pump Div.
Schramm, Inc.
Stanco Mfgs. & Sales, Inc.
Standard Elec. Mfg. Co., Inc.
Swaby Mfg. Co.
Telluride Iron Works Co.
Thor Power Tool Co.
Warren Pumps, Inc.
Weinman Pump Mfg. Co.
WEMCO, DIV. WESTERN MACHINERY CO.
Westinghouse Air Brake Co.
Wheeler Mfg. Co., C. H., Economy Pumps Div.
Wintroath Pumps Div. Worthington Corp.

466 PUMPS, VACUUM

ALLIS-CHALMERS MFG. CO.
American-Marsh Pumps, Inc.
Barrett Haentjens & Co.
Beach-Russ Co.
Bruning Co., Inc., Charles
Central Scientific Co.
CHICAGO PNEUMATIC TOOL CO.
Consolidated Electrodynamics Corp.
Davidson Co., M. T.
Elsler Engineering Co.
Fuller Co.
GARDNER-DENVER CO.
GENERAL AMERICAN TRANSPORTATION CORP.
Goyne Pump Co.
INGERSOLL-RAND CO.
JOY MFG. CO.
McGowan Pump Div., Leyman Mfg. Corp.
Nash Engineering Co.
Penberthy Mfg. Co.
Pennsylvania Pump & Compressor Co.
Precision Thermometer & Instrument Co.
ROOTS-CONNERSVILLE BLOWER DIV. DRESSER INDUSTRIES, INC.
U. S. Hoffman Machinery Corp., Air Appliance Div.
Warren Pumps, Inc.
Wheeler Mfg. Co., C. H., Economy Pump Div.
Worthington Corp.

467 PUMP ACCESSORIES

Barrett Haentjens & Co.
Cutler-Hammer, Inc.
Gatke Corp.
Hypro Engineering, Inc.
Jacuzzi Bros., Inc.
U. S. RUBBER CO.

(PYROMETERS—see Meters, Temperature)

R

468 RADIATION DETECTORS

Automatic Switch Co.
BALL BROTHERS RESEARCH CORP.
Bausch & Lomb Optical Co.
Beckman Instruments, Inc. Berkeley Div.
Carpco Manufacturing, Inc.
CURTISS-WRIGHT CORP. ELECTRONICS DIV.
Detectron Corp.
Engineers Syndicate, Ltd.
Fisher Research Laboratory, Inc.
GENERAL ELECTRIC CO. APPARATUS SALES DIV.
Geophysical Instrument & Supply Co.
Menlo Research Laboratory
MINE & SMELTER SUPPLY CO.
Nuclear-Chicago Corp.
Nuclear Research Corp.
Philips Electronics, Inc. Instruments Div.
Precision Radiation Instruments, Inc.
Radiation Counter Laboratories
Special Instruments Laboratory, Inc.
Tracerlab, Inc.
Ultra-Violet Products, Inc.
Universal Atomics Div. Universal Transistor Products Corp.
VARIAN ASSOCIATES
Victoreen Instrument Co.
Western Radiation Laboratory
WESTINGHOUSE ELECTRIC CORP.
Whites Electronics

(RADIO — see Communications)

469 RAIL & TRACK

AMERICAN BRAKE SHOE CO. AMERICAN MANGANESE STEEL DIV.
Bethlehem Pacific Coast Steel Corp.
BETHLEHEM STEEL CO., INC.
COLORADO FUEL & IRON CORP.
Dominion Steel & Coal Corp., Ltd.
Foster Co., L. B.
Frank, M. K.
Gibraltar Equipment & Mfg. Co.
Ryerson & Son, Inc., Joseph T.
Sweet's Steel Co.
TENNESSEE COAL & IRON DIV. U. S. STEEL CORP.
U. S. STEEL CORP. COLUMBIA-GENEVA STEEL DIV.
WEST VIRGINIA WORKS CONNORS STEEL DIV. H. K. PORTER COMPANY, INC. (DELAWARE)

470 RAIL & TRACK ACCESSORIES — also see specific item under Car . . . Rail . . . or Track

AMERICAN BRAKE SHOE CO.
AMERICAN MINE DOOR CO.
Bethlehem Pacific Coast Steel Corp.
BETHLEHEM STEEL CO., INC.
CARD IRON WORKS, C. S.
CHEATHAM ELECTRIC SWITCHING DEVICE CO.
COLORADO FUEL & IRON CORP.
Conley Frog & Switch Co.
Dominion Steel & Coal Corp., Ltd.
Duquesne Mine Supply Co.
Farrell-Cheek Steel Co.
Foster Co., L. B.
Frank, M. K.
Gibraltar Equipment & Mfg. Co.
Miners' Hardware Supply Co.
NACHOD & U. S. SIGNAL CO.
Nolan Co.
Pettibone Mulliken Corp.
Remington Arms Co., Inc.
TENNESSEE COAL & IRON DIV. U. S. STEEL CORP.
Utility Mine Equipment Co.
U. S. STEEL CORP. COLUMBIA-GENEVA STEEL DIV.
WEST VIRGINIA WORKS CONNORS STEEL DIV. H. K. PORTER COMPANY, INC. (DELAWARE)
Whiting Corp.

471 RAIL BENDERS

Aldon Co.
CARD IRON WORKS, C. S.
Duquesne Mine Supply Co.
Foster Co., L. B.
Frank, M. K.
Gibraltar Equipment & Mfg. Co.
Utility Mine Equipment Co.

472 RAIL BONDS

AMERICAN MINE DOOR CO.
AMERICAN STEEL & WIRE DIV. U. S. STEEL CORP.
Ensign Electric & Mfg. Co.
Frank, M. K.
Gibraltar Equipment & Mfg. Co.
Hales Co., W. M.
Ohio Brass Co.
Penn Machine Co.

U. S. STEEL CORP. COLUMBIA-GENEVA STEEL DIV.

473 RAIL BRACES

AMERICAN BRAKE SHOE CO. AMERICAN MANGANESE STEEL DIV.
Bethlehem Pacific Coast Steel Corp.
BETHLEHEM STEEL CO., INC.
CARD IRON WORKS, C. S.
Conley Frog & Switch Co.
Coover Railroad Track Brace Co.
Foster Co., L. B.
Frank, M. K.
Gibraltar Equipment & Mfg. Co.
Nolan Co.
Pettibone Mulliken Corp.
TENNESSEE COAL & IRON DIV. U. S. STEEL CORP.
U. S. STEEL CORP., COLUMBIA-GENEVA STEEL DIV.
WEST VIRGINIA WORKS CONNORS STEEL DIV. H. K. PORTER COMPANY, INC. (DELAWARE)

474 RAIL CLAMPS, FISHPLATES, TIE-PLATES & FROGS

AMERICAN BRAKE SHOE CO. AMERICAN MANGANESE STEEL DIV.
Bethlehem Pacific Coast Steel Corp.
BETHLEHEM STEEL CO., INC.
Byers Co., A. M.
CARD IRON WORKS, C. S.
COLORADO FUEL & IRON CORP.
Conley Frog & Switch Co.
Dominion Steel & Coal Corp., Ltd.
Foster Co., L. B.
Frank, M. K.
Frog, Switch & Mfg. Co.
Gibraltar Equipment & Mfg. Co.
Pettibone Mulliken Corp.
TENNESSEE COAL & IRON DIV. U. S. STEEL CORP.
U. S. STEEL CORP. COLUMBIA-GENEVA STEEL DIV.
WEST VIRGINIA WORKS CONNORS STEEL DIV. H. K. PORTER COMPANY, INC. (DELAWARE)

475 RAIL DRILLS & PUNCHES

Denver Equipment Co.
Foster Co., L. B.
Frank, M. K.
Gibraltar Equipment & Mfg. Co.
NORDBERG MFG. CO.
Ohio Brass Co.

476 RAIL SIGNALS — also see Communications

AMERICAN MINE DOOR CO.
Bethlehem Pacific Coast Steel Corp.
Frank, M. K.
General Equipment & Mfg. Co.
Miners' Hardware Supply Co.
NACHOD & U. S. SIGNAL CO.
NATIONAL FILTER MEDIA CORP.
Taller & Cooper, Inc.
Union Switch & Signal Div., Westinghouse Air Brake Co.

477 RAIL SPIKES

Bethlehem Pacific Coast Steel Corp.
BETHLEHEM STEEL CO., INC.
COLORADO FUEL & IRON CORP.
Dominion Steel & Coal Corp., Ltd.
Foster Co., L. B.
Frank, M. K.
Gibraltar Equipment & Mfg. Co.
Republic Steel Corp.
Ryerson & Son, Inc., Joseph T.
Screw & Bolt Corp. of America
SHEFFIELD DIV. ARMCO STEEL CORP.
TENNESSEE COAL & IRON DIV. U. S. STEEL CORP.
U. S. STEEL CORP. COLUMBIA-GENEVA STEEL DIV.
Youngstown Sheet & Tube Co.

478 RAIL SWITCHES & CROSSINGS

American Brake Shoe Co.
Bethlehem Pacific Coast Steel Corp.
BETHLEHEM STEEL CO., INC.
CARD IRON WORKS, C. S.
Conley Frog & Switch Co.
Foster Co., L. B.
Frank, M. K.
Frog, Switch & Mfg. Co.
Gibraltar Equipment & Mfg. Co.
Pettibone Mulliken Corp.
TENNESSEE COAL & IRON DIV. U. S. STEEL CORP.
U. S. STEEL CORP., COLUMBIA-GENEVA STEEL DIV.
WEST VIRGINIA WORKS CONNORS STEEL DIV. H. K. PORTER COMPANY, INC. (DELAWARE)

479 RAIL SWITCH THROWERS

AMERICAN MINE DOOR CO.
Bethlehem Pacific Coast Steel Corp.
BETHLEHEM STEEL CO., INC.
CARD IRON WORKS, C. S.
CHEATHAM ELECTRIC SWITCHING DEVICE CO.
Conley Frog & Switch Co.
Foster Co., L. B.
Frank, M. K.
General Equipment & Mfg. Co.
TENNESSEE COAL & IRON DIV. U. S. STEEL CORP.
Union Switch & Signal Div. Westinghouse Air Brake Co.
WEST VIRGINIA WORKS CONNORS STEEL DIV. H. K. PORTER COMPANY, INC. (DELAWARE)

480 RAIL TIES, STEEL

Bethlehem Pacific Coast Steel Corp.
BETHLEHEM STEEL CO., INC.
Foster Co., L. B.
Frank, M. K.
Gibraltar Equipment & Mfg. Co.
Sweet's Steel Co.
U. S. STEEL CORP. COLUMBIA-

GENEVA STEEL DIV.
WEST VIRGINIA WORKS CONNORS STEEL DIV. H. K. PORTER COMPANY, INC. (DELAWARE)

(REAGENTS—see: Chemicals; Flotation Reagents; Water Clarification Chemicals)

(REAGENT FEEDERS — see Feeders)

(RECTIFIERS — see Electric Rectifiers)

(REFRACTORIES—see below; also see Insulation)

481 REFRACTORIES, BRICK

BABCOCK & WILCOX CO.
Corhart Refractories Co.
Denver Fire Clay Co.
Electro Refractories & Abrasives Corp.
General Refractories Co.
Gladding McBean & Co.
Green Fire Brick Co., A. P.
HARBISON-WALKER REFRACTORIES CO.
Ironton Fire Brick Co.
Johns-Manville
Kaiser Aluminum & Chemical Sales, Inc.
LACLEDE-CHRISTY WORKS, REFRACTORIES DIV., H. K. PORTER COMPANY, INC.
Mexico Refractories Co.
MULLITE WORKS REFRACTORIES DIV. H. K. PORTER COMPANY, INC.
National Lead Co.
North American Refractories Co.
Norton Co.
PORTER COMPANY INC., H. K., REFRACTORIES DIV.
Quigley Co., Inc.
Refractory & Insulation Corp.
Robinson Clay Product Co.
Samuel & Co., Inc., Frank

482 REFRACTORIES, CASTABLE

BABCOCK & WILCOX CO.
Denver Fire Clay Co.
Electro Refractories & Abrasives Corp.
General Refractories Co.
Gladding, McBean & Co.
Green Fire Brick Co., A. P.
HARBISON-WALKER REFRACTORIES CO.
Ironton Fire Brick Co.
Johns-Manville
Kaiser Aluminum & Chemical Sales, Inc.
LACLEDE-CHRISTY WORKS, REFRACTORIES DIV., H. K. PORTER CO., INC.
Mexico Refractories Co.
MULLITE WORKS REFRACTORIES DIV. H. K. PORTER COMPANY, INC.
North American Refractories Co.
Norton Co.
Pettinos, Inc., George F.
PORTER COMPANY INC., H. K., REFRATORIES DIV.
Quigley Co., Inc.
Refractory & Insulation Corp.
Robinson Clay Product Co.
Sauereisen Cement Co.
Samuel & Co., Inc., Frank
Spang & Co.

483 REFRACTORY CEMENT

BABCOCK & WILCOX CO.
Carey Mfg. Co., Philip
Corhart Refractories Co.
Denver Fire Clay Co.
Dixon Crucible Co., Joseph
Eagle-Picher Co.
Electro Refractories & Abrasives Corp.
General Refractories Co.
Gladding, McBean & Co.
Green Fire Brick Co., A. P.
HARBISON-WALKER REFRACTORIES CO.
Ironton Fire Brick Co.
Kaiser Aluminum & Chemical Sales, Inc.
Johns-Manville
LACLEDE-CHRISTY WORKS, REFRACTORIES DIV., H. K. PORTER COMPANY. INC.
Mexico Refractories Co.
MULLITE WORKS REFRACTORIES DIV. H. K. PORTER COMPANY, INC.
National Carbon Co. Div. Union Carbide Corp.
North American Refractories Co.
Norton Co.
Pettinos, Inc., George F.
PORTER COMPANY INC., H. K., REFRACTORIES DIV.
Quigley Co., Inc.
Refractory & Insulation Corp.
Robinson Clay Product Co.
Samuel & Co., Inc., Frank
Sauereisen Cement Co.
Spang & Co.

484 REFRACTORY MATERIAL OTHER THAN ABOVE

Aluminum Co. of America
BABCOCK & WILCOX CO.
Denver Fire Clay Co.
Du Pont de Nemours & Co., Inc.
General Refractories Co.
Gladding, McBean & Co.
Green Fire Brick Co., A. P.
HARBISON-WALKER REFRACTORIES CO.
Ironton Fire Brick Co.
Johns-Manville
Kaiser Aluminum & Chemical Sales, Inc.
Klemp Metal Grating Corp.
LACLEDE-CHIRSTY WORKS, REFRACTORIES DIV., H. K. PORTER CO., INC.
Mexico Refractories Co.
Michigan Chemical Corp.
Monsanto Chemical Co.
MULLITE WORKS, REFRACTORIES DIV. H. K. PORTER CO., INC.
National Carbon Co. Div. Union Carbide Corp.
North American Refractories Co.
Norton Co.
PORTER COMPANY INC., H. K., REFRACTORIES DIV.
Quigley Co., Inc.
Refractory & Insulation Corp.
Reintjes Co., George P.
Robinson Clay Product Co.

485 REFRACTORY PLACERS, SPRAYERS, PUMPS & BLOWERS

Cement Gun Co.
Engineered Equipment Inc.
Green Fire Brick Co., A. P.
Kaiser Aluminum & Chemical Sales, Inc.
Mexico Refractories Co.
Quigley Co., Inc.

(RESPIRATORS — see Safety Respirators)

486 RETORTS & DISTILLATION PROCESS EQUIPMENT LIQUID, — does not include: Boilers; Laboratory Equipment

Graver Tank & Mfg. Co., Div. Union Tank Car Co.
MINE & SMELTER SUPPLY CO.
Standard Steel Corp.

487 RETORTS & DISTILLATION PROCESS EQUIPMENT, SOLID — also see: Furnaces; Kilns; does not include Laboratory Equipment

GOULD CO., GORDON I.
Hevi-Duty Electric Co.
Standard Steel Corp.

488 ROCK (& ROOF) BOLTS

AMERICAN BRIDGE DIV., U. S. STEEL CORP.
Bethlehem Pacific Steel Corp.
BETHLEHEM STEEL CO., INC.
COLORADO FUEL & IRON CORP.
Commercial Shearing & Stamping Co.
Hales Co., W. M.
Hayes Steel Products, Ltd.
Lamson & Sessions Co.
Ohio Brass Co.
Pattin Manufacturing Co.
REPUBLIC STEEL CORP.
Sika Chemical Corp.
WEST VIRGINIA WORKS CONNORS STEEL DIV. H. K. PORTER CO., INC. (DELAWARE)
WICKWIRE SPENCER STEEL DIV. COLORADO FUEL & IRON CORP.
Youngstown Sheet & Tube Co.

489 ROCK (& ROOF) BOLT ACCESSORIES

Airdox-Cardox Products Co.
AMERICAN BRIDGE DIV., U. S. STEEL CORP.
Bethlehem Pacific Coast Steel Corp.
BETHLEHEM STEEL CO., INC.
Central Mine Equipment Co.
COLORADO FUEL & IRON CORP.
CONTINENTAL GIN CO.
GOODYEAR TIRE & RUBBER CO. INDUSTRIAL PRODUCTS
Greene, Keede & Co.
Hayes Steel Products, Ltd.
Herold Mfg. Co.
INGERSOLL-RAND CO.
Ohio Brass Co.
Palnut Co.
Pattin Manufacturing Co.
SHEFFIELD DIV. ARMCO STEEL CORP.
Sika Chemical Corp.
Thompson Products Valve Div., Thompson Ramo Wooldridge, Inc.
WEST VIRGINIA WORKS CONNORS STEEL DIV. H. K. PORTER COMPANY, INC. (DELAWARE)
WICKWIRE SPENER STEEL DIV. COLORADO FUEL & IRON CORP.
Youngstown Sheet & Tube Co.

490 ROOF BOLTING MACHINES

Acme Machinery Co.
Airdox-Cardox Products Co.
ATLAS COPCO PACIFIC, INC.
CHICAGO PNEUMATIC TOOL CO.
Fletcher & Co., J. H.
GARDNER-DENVER CO.
Goodman Manufacturing Co.
Hayes Steel Products, Ltd.
Holman Bros.—Canada Ltd.
INGERSOLL-RAND CO.
JEFFREY MFG. CO.
JOY MFG. CO.
LE ROI DIV. WESTINGHOUSE AIR BRAKE CO.
Schroeder Brothers Corp.
Thor Power Tool Co.

491 ROOFING & SIDING, METAL

Aluminum Co. of America
American Brass Co.
Arrowhead Steel Buildings, Inc.
BETHLEHEM STEEL CO., INC.
Butler Manufacturing Co.
CRUCIBLE STEEL CO. OF AMERICA
Inland Steel Products Co.
INTERNATIONAL NICKEL CO.
Kaiser Aluminum & Chemical Sales, Inc.
Mahon Co., R. C.
REPUBLIC STEEL CORP.
Ryerson & Son, Inc., Joseph T.
TENNESSEE COAL & IRON DIV., U. S. STEEL CORP.
U. S. STEEL CORP. COLUMBIA-GENEVA STEEL DIV.

492 ROOFING & SIDING, NON-METALLIC

Carey Mfg. Co., Philip
Koppers Co. Inc.
Johns-Manville
Keasbey & Mattison Co.
Ruberoid Co.
STANDARD OIL CO., OF CALIFORNIA WESTERN OPERATIONS, INC.

493 ROPE & TWINE (HEMP, ET AL)—does not include Wire Rope

Flocker & Co., John
Van Waters & Rogers, Inc.

(RUST PREVENTIVES — see Coatings)

S

494 SAFETY CLOTHING, GLOVES, HATS, BELTS, SHOES, ETC.

Air Reduction Sales Co. Div. Air Reduction Co., Inc.
American Optical Co.
Bud Insulated Products, Inc.
Bullard Co., E. D.
Goodall Rubber Co.
GOODRICH INDUSTRIAL PRODUCTS CO., B. F.
Graton & Knight Co., Inc.
Industrial Air Products Co.
Industrial Gloves Co.
International Shoe Co.
Johns-Manville
Judsen Rubber Works, Inc.
Keasbey & Mattison Co.
Miller Equipment Co., Inc.
MINE SAFETY APPLIANCES CO.
National Cylinder Gas, Div. Chemetron Corp.
NATIONAL MINE SERVICE CO.
Parker Safety Equipment Co.
Penn Mfg. & Supply Co.
Pickard Industries, Inc. Central Mine Supply Co., Div.
Pulmosan Safety Equipment Corp.
Ray-O-Vac Co., Div. Electric Storage Battery Co., Willson Products Div.
Rose Mfg. Co.
Safety Cothing & Equipment Co.
Safety First Shoe Co., Inc.
Safety First Supply Co.
Snyder & Son, Inc., M. L.
U. S. RUBBER CO.
Wilson Rubber Co.

495 SAFETY EQUIPMENT & ACCESSORIES—does not include: Dust Samplers; Safety Clothing; Safety Goggles & Masks; Safety Posters; Safety Respirators. Also see: Fire Fighting; First Aid; Meters

Aldon Co.
Beryllium Corp.
Falcon Alarm Co., Inc.
Justrite Manufacturing Co.
MINE SAFETY APPLIANCES CO.
Wolf Safety Lamp Co. of America, Inc.

496 SAFETY GOGGLES & MASKS

Air Reduction Sales Co., Div. Air Reduction Co., Inc.
American Optical Co.
Bausch & Lomb Optical Co.
Binks Mfg. Co.
Bullard Co., E. D.
Chicago Eye Shield Co.
Industrial Air Products Co.
Johns-Manville
MINE SAFETY APPLIANCES CO.
National Cylinder Gas, Div. Chemetron Corp.
NATIONAL MINE SERVICE CO.
Parker Safety Equipment Co.
Pulmosan Safety Equipment Corp.
Ray-O-Vac Co., Div. Electric Storage Battery Co.
Safety Clothing & Equipment Co.
Scott Aviation Corp.
Sellstrom Mfg. Co.
U. S. Safety Service Co.
Willson Products Div. Ray-O-Vac Co.

(SAFETY POSTERS — see Signs)

497 SAFETY RESPIRATORS

American Optical Co.
Binks Mfg. Co.
Bullard Co., E. D.
Chicago Eyeshield Co.
Flexo Products, Inc.
MINE SAFETY APPLIANCES CO.
NATIONAL MINE SERVICE CO.
Pulmosan Safety Equipment Corp.
Ray-O-Vac Co., Div. Electric Storage Battery Co.
Safety Clothing & Equipment Co.
Scott Aviation Corp.

498 SAMPLING DEVICES, ORE, CONCENTRATE, ETC. (MECHANICAL)—does not include: Meters

Canadian Locomotive Co., Ltd.
Carpco Manufacturing, Inc.
Dagley Mfg. Co.
Denver Equipment Co.
Galigher Co.
HARDINGE CO., INC.
Heyl & Patterson, Inc.
MACHINERY CENTER INC.
MINE & SMELTER SUPPLY CO., MFG. DIV.
STURTEVANT MILL CO.

(SAWS—see below; also see Tools)

499 SAWS, CONCRETE & MASONRY

Clipper Mfg. Co.
Engineered Equipment, Inc.
Green Fire Brick Co., A. P.

500 SCALES, AUTOMATIC

WEIGHING — also see Feeders

ABCs Scale Div. McDowell Co., Inc.
Aerofall Mills, Inc.
B-I-F Industries, Inc.
Buffalo Scale Co., Inc.
Butler Bin Co.
Consolidated Packaging Machinery Corp.
Erie Strayer Co.
FAIRBANKS, MORSE & CO.
Howe Scale Co., Inc.
INDUSTRIAL PHYSICS & ELECTRONICS CO.
Johnson Co., C. S.
MERRICK SCALE MFG. CO.
Richardson Scale Co.
St. Regis Paper Co.
Schaffer Poidometer Co.
Stephens-Adamson Mfg. Co.
Streeter-Amet Co.
Taller & Cooper, Inc.
Thurman Machine Co.
Toledo Scale Div. Toledo Scale Corp.
Torsion Balance Co.
Trans-Weigh Corp.
Voland & Sons, Inc.
Webb Corp.

501 SCALES, PLATFORM

Bonded Scale & Machine Co.
Buffalo Scale Co., Inc.
Chatillon & Sons, John
FAIRBANKS, MORSE & CO.
Howe Scale Co., Inc.
Johnson Co., C. S.
Streeter-Amet Co.
Taller & Cooper, Inc.
Thurman Machine Co.
Toledo Scale, Div. Toledo Scale Corp.
Webb Corp.

502 SCALES, SACKING

BEMIS BRO. BAG CO.
Consolidated Packaging Machinery Corp.
FAIRBANKS, MORSE & CO.
Howe Scale Co., Inc.
Richardson Scale Co.
St. Regis Paper Co.
Toledo Scale, Div. Toledo Scale Corp.

503 SCALES, WEIGH HOPPER—also see Feeders

ABCs Scale Div. McDowell Co., Inc.
Atlas Car & Mfg. Co.
Buffalo Scale Co., Inc.
Butler Bin Co.
Engineered Equipment Inc.
Erie Strayer Co.
FAIRBANKS, MORSE & CO.
Howe Scale Co., Inc.
Johnson Co., C. S.
Manning, Maxwell & Moore, Inc. Shaw Box Crane & Hoist Div.
Nolan Co.
Richardson Scale Co.
Streeter-Amet Co.
Taller & Cooper, Inc.
Thurman Machine Co.
Toledo Scale, Div. Toledo Scale Corp.
Webb Corp.

(SCIENTIFIC INSTRUMENTS —see: Laboratory & Scientific Instruments; Chemical Lab. Equip.; Meters; Geophysical Instruments; Spectroscopic Instruments; Drafting Equip.; Surveying Equip.)

(SCINTILLATION COUNTERS—see Radiation Detectors)

(SCRAPERS, DRAGLINE—see Buckets, Dragline Scraper-Slusher; Hoists, Dragline Scraper-Slusher Excavators, Dragline Tower)

504 SCRAPERS, WHEELED, SELF-PROPELLED & TOWED (EARTHMOVING)

ALLIS-CHALMERS MFG. CO.
American Tractor Equipment Corp.
Ateco Div. Greenville Steel Car Co.
CATERPILLAR TRACTOR CO.
CLARK EQUIPMENT CO. CONSTRUCTION MACHINERY DIV.
Continental Copper & Steel Industries Inc. Wooldridge Div.
EUCLID DIV. GENERAL MOTORS CORP.
INTERNATIONAL HARVESTER EXPORT CO.
Landis Steel Co.
LE TOURNEAU-WESTINGHOUSE CO.
Oliver Corp.

(SCREEN CLOTH—see Wire Cloth)

505 SCREEN ECCENTRICS & VIBRATORS — also see Vibrators

Davis Foundry & Machine Works
Diamond Iron Works Div. Goodman Mfg. Co.
DRAVO CORP.
Hack Engineering Co.
HEWITT-ROBINS, INC.
IOWA MFG. CO.
Lecco Machinery & Engineering Co.
LINK-BELT CO.
MACHINERY CENTER INC.
Overstrom & Sons, Inc.
Southwestern Engineering Co.
TYLER CO., W. S.
Universal Vibrating Screen Co.
Universal Dredge Mfg. Co.

506 SCREEN HEATERS

ALLIS-CHALMERS MFG. CO.
DEISTER CONCENTRATOR CO.
HEWITT-ROBINS, INC.
LINK-BELT CO.
Overstrom & Sons, Inc.
Screen Equipment Co., Inc.
Southwestern Engineering Co.
TYLER CO., W. S.
Universal Vibrating Screen Co.

507 SCREEN PLATES & SHEET

AMERICAN BRAKE SHOE CO. AMERICAN MANGANESE STEEL DIV.
CARD IRON WORKS, C. S.
Chicago Perforating Co.
Columbia Steel Casting Co., Inc.
HENDRICK MFG. CO.
HEWITT-ROBINS, INC.
Irwin-Sensenich Corp.
Kanawha Mfg. Co.
Laubenstein Mfg. Co.
LINK-BELT CO.
Manganese Steel Forge Co.
McNALLY PITTSBURG MFG. CO.
Multi-Metal Wire Cloth Co., Inc.
NATIONAL MALLEABLE & STEEL CASTINGS CO.
Pickard Industries, Inc. Central Mine Supply Co., Div.
YUBA CONSOLIDATED INDUSTRIES, INC., YUBA MINING DIV.

508 SCREEN, WIRE & BAR

Bixby-Zimmer Engr. Co.
Buffalo Wire Works Co.
Cambridge Wire Cloth Co.
Chain Belt Co.
COLORADO FUEL & IRON CORP.
HENDRICK MFG. CO.
HEWITT-ROBINS, INC.
Hoyt Wire Cloth Co.
IOWA MFG. CO.
JEFFREY MFG. CO.
LINK-BELT CO.
Ludlow-Saylor Wire Cloth Co.
Manganese Steel Forge Co.
McNALLY PITTSBURG MFG. CORP.
Newark Wire Cloth Co.
Pickard Industries, Inc., Central Mine Supply Co., Div.
Pioneer Engineering Div. Poor & Co. Inc.
Southwestern Engineering Co.
Specialty Engineering Co.
Star Wire Screen & Iron Works, Inc.
TYLER CO., W. S.
WEDGE WIRE CORP.
WICKWIRE SPENCER STEEL DIV. COLORADO FUEL & IRON CORP.

509 SCREENS, ELECTRICALLY HEATED

Acme Road Machinery Co., Inc.
ALLIS-CHALMERS MFG. CO.
DEISTER CONCENTRATOR CO.
Deister Machine Co.
HEWITT-ROBINS, INC.
LINK-BELT CO.
Lipmann Engineering Works, Inc.
Overstrom & Sons, Inc.
Pickard Industries, Inc. Central Mine Supply Co., Div.
Productive Equipment Corp.
Screen Equipment Co., Inc.
SIMPLICITY ENGINEERING CO.
Southwestern Engineering Co.
TYLER CO., W. S.
Universal Vibrating Screen Co.

510 SCREENS, GRAVITY

AMERICAN BRAKE SHOE CO. AMERICAN MANGANESE STEEL DIV.
BARBER-GREENE CO.
Cambridge Wire Cloth Co.
Chicago Perforating Co.
COLORADO FUEL & IRON CORP.
DORR-OLIVER, INC.
HENDRICK MFG. CO.
HEWITT-ROBINS, INC.
Laubenstein Mfg. Co.
LINK-BELT CO.
Lippmann Engineering Works, Inc.
Newark Wire Cloth Co.
Nolan Co.
Stearns Roger Mfg. Co.
TYLER CO., W. S.
Universal Road Machinery Co.
Universal Vibrating Screen Co.
WEDGE WIRE CORP.
WICKWIRE SPENCER STEEL DIV. COLORADO FUEL & IRON CORP.

511 SCREENS, REVOLVING (TROMMEL)

Acme Road Machinery Co., Inc.
ALLIS-CHALMERS MFG. CO.
Bartlett & Snow Co., C. O.
Bodinson Manufacturing Co., Inc.
Buffalo Wire Works Co.
Cambridge Wire Cloth Co.
CARD IRON WORKS, C. S.
COLORADO FUEL & IRON CORP.
Chicago Perforating Co.
Davis Foundry & Machine Works
Denver Equipment Co.
Diamond Iron Works Div., Goodman Mfg. Co.
DIESEL ENERGY CORP.
Gruendler Crusher & Pulverizer Co.
Hack Engineering Co.
HENDRICK MFG. CO.
Laubenstein Mfg. Co.
LINK-BELT CO.
Lippmann Engineering Works, Inc.
McLANAHAN & STONE CORP.
NATIONAL IRON CO.
Minerals Engineering Co.
Newark Wire Cloth Co.
Pioneer Engineering Div. Poor & Co. Inc.
Rogers Iron Works Co.
Smith Engineering Works
Stephens-Adamson Mfg. Co.
TRAYLOR ENGINEERING & MFG. CO.
TYLER CO., W. S.
Universal Dredge Mfg. Co.
Universal Road Machinery Co.
Washington Iron Works
Washington Machinery Co.
WICKWIRE SPENCER STEEL DIV. COLORADO FUEL & IRON CORP.
YUBA CONSOLIDATED INDUSTRIES, INC., YUBA MINING DIV.

512 SCREENS, SHAKING & VIBRATING

Acme Road Machinery Co., Inc.
Aerofall Mills, Inc.
Ajax Flexible Coupling Co.
ALLIS-CHALMERS MFG. CO.
Bacon-Greene & Milroy
BARBER-GREENE CO.
Bonded Scale & Machine Co.
Buffalo Wire Works Co.
Cambridge Wire Cloth Co.
Canadian Locomotive Co., Ltd.
Carpco Manufacturing, Inc.
Carrier Conveyor Corp.
Chicago Perforating Co.
COLORADO FUEL & IRON CORP.
Daniels Co. Contractors, Inc.
Davis Foundry & Machine Works
DEISTER CONCENTRATOR CO.
Deister Machine Co.
Denver Equipment Co.
Diamond Iron Works Div. Goodman Mfg. Co.
DIESEL ENERGY CORP.
DORR-OLIVER, INC.
DRAVO CORP.
EXOLON CO.
Fahrenwald Co., A. W.
Gilson Screen Co.
Gruendler Crusher & Pulverizer Co.
Hack Engineering Co.
Hammermills, Inc.
HENDRICK MFG. CO.
HEWITT-ROBINS, INC.
Industrial Engrg. & Construction Co.
IOWA MFG. CO.
JEFFREY MFG. CO.
Kanawha Mfg. Co.
KENNEDY-VAN SAUN MFG. & ENG. CORP.
Laubenstein Mfg. Co.
Lecco Machinery & Engineering Co.
LINK-BELT CO.
Lippmann Engineering Works, Inc.
MACHINERY CENTER, INC.
McNALLY PITTSBURG MFG. CORP.
Meckum Engineering, Inc.
Multi-Metal Wire Cloth Co., Inc.
Newark Wire Cloth Co.
NORDBERG MFG. CO.
Overstrom & Sons, Inc.
Patterson Foundry & Machine Co.
Pioneer Engineering Div. Poor & Co. Inc.
Prins & Associates, K.
Productive Equipment Corp.
Ridge Equipment Co.
Roberts & Schaefer Co., Subsidiary of Thompson Starrett Co., Inc.
Rogers Iron Works Co.
Savage Co., W. J.
Screen Equipment Co., Inc.
SIMPLICITY ENGINEERING CO.
Smith Engineering Works
Southwestern Engineering Co.
Specialty Engineering Co.
STEARNS ROGER MFG. CO.
Stephens-Adamson Mfg. Co.
STURTEVANT MILL CO.
Syntron Co.
TYLER CO., W. S.
Universal Dredge Mfg. Co.
Universal Engineering Corp.
Universal Vibrating Screen Co.
WEDGE WIRE CORP.
WICKWIRE SPENCER STEEL DIV. COLORADO FUEL & IRON CORP.
Williams Patent Crusher & Pulverizer Co.
YUBA CONSOLIDATED INDUSTRIES DIV., YUBA CONSOLIDATED INDUSTRIES CO.

(SCRUBBERS, ENGINE EXHAUST—see Engine Exhaust Scrubbers)

513 SCRUBBERS, AIR & WASTE GAS—also see: Dust Collectors; Gas Separation Process Equipment

Arrow Tank Co.
Atlantic Tank Corp.
Black, Sivalls & Bryson, Inc.
DORR-OLIVER, INC.
DUCON, INC.
Fuller Co., Lehigh Fan & Blower Div.
Graver Tank & Mfg. Co., Div. Union Tank Car Co.
Hagan Chemicals & Controls, Inc. Divisions: Calgon Co., Hall Laboratories
Johnson-March Corp.
Mahon Co., R. C.
McNALLY PITTSBURG MFG. CORP.
National Tank & Pipe Co.
Santa Fe Tank Div. Fluor Products Co.
Schneible Co., Claude B.
Simplicity System Co.
Standard Steel Corp.
WESTERN PRECIPITATION CORP.
Wheelabrator Corp.

514 SCRUBBERS & WASHERS, MINERAL — also see: Agitators, Washing Plants

Acme Road Machinery Co., Inc.
ALLIS-CHALMERS MFG. CO.
Bacon-Greene & Milroy
Bodinson Manufacturing Co., Inc.
Booth Co.
Canadian Locomotive Co., Ltd.
Daniels Co. Contractors, Inc.
Davis Foundry & Machine Works
Denver Equipment Co.
DIESEL ENERGY CORP.
Eagle Iron Works
Georgia Iron Works Co.
Gruendler Crusher & Pulverizer Co.
Hack Engineering Co.
HARDINGE CO., INC.
Hirsch Bros. Machy. Co.
IOWA MFG. CO.
LINK-BELT CO.
Lippmann Engineering Works, Inc.
McLANAHAN & STONE CORP. DIV.
Meckum Engineering, Inc.
MINE & SMELTER SUPPLY CO., MFG. DIV.
MIXING EQUIPMENT CO.
Pioneer Engineering Div. Poor & Co. Inc.
Rogers Iron Works Co.
Simplicity System Co.
Smith Engineering Works
STEARNS ROGER MFG. CO.
TYLER CO., W. S.
Universal Dredge Mfg. Co.

Universal Engineering Corp.
Universal Road Machinery Co.
WEMCO, DIV. WESTERN MACHINERY CO.
YUBA CONSOLIDATED INDUSTRIES, INC. YUBA MINING DIV.

SEPARATORS & CONCENTRATORS — see below; also see: Amalgamating Process Equipment (special); Asbestos Milling Equipment (special); Classifiers; Cyaniding; Process Equipment (special); Diamond Concentrating Equipment (special); Filters; Flotation Machines; Gas Separation Equipment (special); Ion Exchange Equipment (special); Kilns; Retorts and Distillation Equipment; Screens; Scrubbers; Solvent Extraction Equipment (special); Thickeners

515 SEPARATORS, ELECTROSTATIC & HIGH TENSION

Carpco Manufacturing, Inc.

516 SEPARATORS, HEAVY MEDIA TYPE—for separation and recovery of media alone, see: Separators, Magnetic; Screens; or other units.

Daniels Co. Contractors, Inc.
DIESEL ENERGY CORP.
DEISTER CONCENTRATOR CO.
DORR-OLIVER, INC.
Eagle Iron Works
Fuel Process Co.
HARDINGE CO., INC.
JEFFREY MFG. CO.
LINK-BELT CO.
McNALLY PITTSBURG MFG. CORP.
MINE & SMELTER SUPPLY CO., MFG. DIV.
Ore & Chemical Corp.
Prins & Associates, K.
Roberts & Schaefer Co., Subsidiary of Thompson Starrett Co., Inc.
Southwestern Engineering Co.
STEARNS MAGNETIC PRODUCTS
WEMCO, DIV. WESTERN MACHINERY CO.

517 SEPARATORS, JIG, DRY

Bico, Inc.
DEISTER CONCENTRATOR CO.
DIESEL ENERGY CORP.
JEFFREY MFG. CO.
LINK-BELT CO.
Roberts Schaefer Co., Subsidiary of Thompson Starrett Co., Inc.
Sutton, Steele & Steele, Inc.

51 SEPARATORS, JIG, WET

Davis Foundry & Machine Works
DEISTER CONCENTRATOR CO.
Denver Equipment Co.
DIESEL ENERGY CORP.
DORR-OLIVER, INC.
Hirsch Bros. Machy. Co.
JEFFREY MFG. CO.
KENNEDY-VAN SAUN MFG. & ENG. CORP.
LINK-BELT CO.
McLANAHAN & STONE CORP.
McNALLY PITTSBURG MFG. CORP.
Meckum Engineering, Inc.
Prins & Associates
WEMCO, DIV. WESTERN MACHINERY CO.
YUBA CONSOLIDATED INDUSTRIES, INC., YUBA MINING DIV.

519 SEPARATORS, MAGNETIC, BELT & DRUM

Carpco Manufacturing, Inc.
CRUCIBLE STEEL CO. OF AMERICA
Daniels Co. Contractors, Inc.
DIESEL ENERGY CORP.
Dings Magnetic Separator Co.
Engineers Syndicate, Ltd.
Eriez Mfg. Co.
EXOLON CO.
Frantz Co., Inc., S. G.
Homer Mfg. Co.
JEFFREY MFG. CO.
Magnetic Engineering & Mfg. Co.
Shrader Co., F. W.
STEARNS MAGNETIC PRODUCTS

520 SEPARATORS, SHAKING TABLE, WET

Carpco Mnaufacturing, Inc.
Dagley Mfg. Co.
DEISTER CONCENTRATOR CO.
Deister Machine Co.
Denver Equipment Co.
DIESEL ENERGY CORP.
JEFFREY MFG. CO.
LINK-BELT CO.
KENNEDY-VAN SAUN MFG. & ENG. CORP.
MINE & SMELTER SUPPLY CO., MFG. DIV.

521 SEPARATORS, SHAKING TABLE, DRY (AIR)

DIESEL ENERGY CORP.
KENNEDY-VAN SAUN MFG. & ENG. CORP.
LINK-BELT CO.
Roberts & Schaefer Co., Subsidiary of Thompson Starrett Co., Inc.
Sutton, Steele & Steele Inc.
Wilkerson Corp.
Williams Patent Crusher & Pulverizer Co.

522 SEPARATORS, SLUICE (TROUGH) SPIRAL & SIMILAR FILM GRAVITY TYPES

Carpco Manufacturing, Inc.
Cannon Concentrator Co.
DIESEL ENERGY CORP.
LINK-BELT CO.

(SHAFT MUCKING MACHINES — see Loaders, Special Mine Shaft Mucking)

(SHEAVES—see below; also see Blocks)

523 SHEAVES, MINE HOIST

AMERICAN BRAKE SHOE CO. AMERICAN MANGANESE STEEL DIV.
AMERICAN HOIST & DERRICK CO.
CARD IRON WORKS, C. S.
Coeur d'Alene Hardware & Foundry Co.
CONNELLSVILLE MFG. & MINE SUPPLY CO.
Dick Co., R. & J.
Farrell-Cheeck Steel Co.
Frog, Switch & Mfg. Co.
Hirsch Bros. Machy. Co.
Holmes & Bros., Inc. Robert
Irwin-Sensenich Corp.
JOY MFG. CO.
Lake Shore, Inc.
Madesco Tackle Block Co.
Mayo Tunnel & Mine Equipment
McDowell Co., Inc.
McKiernan-Terry Corp., Mead Morrison Div.
Mc Millan's Sons, W. H.
NATIONAL IRON CO.
NATIONAL MALLEABLE & STEEL CASTINGS CO.
NORDBERG MFG. CO.
Ogden Iron Works
Princeton Griphoist, Inc.
Rogers Iron Works Co.
Sanford-Day Iron Works, Inc.
Skookum Co., Inc.
Stroh Process Steel Co.
Tool Steel Gear & Pinion Co.
VULCAN IRON WORKS CO. (VULCAN-DENVER)
West Virginia Armature Co.
Western Block Co.
Wood's Sons Co., T. B.
Worthington Corp.
YUBA CONSOLIDATED INDUSTRIES, INC. YUBA MINING DIV.

524 SHOP EQUIPMENT MACHINE, FABRICATING & REPAIR POWERED (LATHES) PRESSES, ETC.)—does not include Blast Cleaning Equipment; Conveyor Belting Vulcanizers; Cranes; Drill Bit & Steel Forging Hammers; Electric Cable Splicers & Vulcanizers; Forges; Furnaces; Grinders & Buffers; Hoists; Lift; Metallizing Equipment; Timber Framing Machines; Tools, Hand & Power; Welding & Cutting Equip.; Steam Cleaning Equip.

CONNELLSVILLE MFG & MINE SUPPLY CO .
Industrial Air Products Co.
Kanawha Mfg. Co.
LOGAN ENGINEERING CO.
Master Mfg. Co.
Mead Mill Co.
NATIONAL IRON CO.
Owatoonna Tool Co.
Remington Arms Co., Inc.
Rockwell Mfg. Co., Delta Power Tool Div.
Savage Co., W. J.
South Bend Lathe Works
VULCAN IRON WORKS CO. (VULCAN-DENVER)
Wellman Engineering Co.
Western Gear Corp.
Wheeler Mfg. Co., C. H.

(SHOVELS — see Excavators, Tools)

(SHUTTLE CARS—see Trucks, Shuttle Car)

(SIEVES—see below; also see Screens)

526 SIEVES, TESTING

Bico, Inc.
Central Scientific Co.
Fahrenwald Co., A. W.
Fisher Scientific Co.
HENDRICK MFG. CO.
Laubenstein Mfg. Co.
Newark Wire Cloth Co.
TYLER CO., W. S.

(SIGNALS—see Communications)

527 SIGNS—POSTERS

Brady Co., W. H.
Dicke Tool Co.
Elliott Service Co., Inc.
MINE SAFETY APPLIANCES CO.
Safety Clothing & Equipment Co.

528 SINTERING EQUIPMENT (SPECIAL)—does not include: Furnaces; Kilns; Nodulizing Equipment.

ALLIS-CHALMERS MFG. CO.
B-I-F Industries, Inc.
DRAVO CORP.
Dwight-Lloyd Div. McDowell Co., Inc.
Hauck Manufacturing Co.
Koppers Co., Inc.
MACE CO.
McDowell Co., Inc.
NATIONAL MALLEABLE & STEEL CASTINGS CO.
Sanford-Day Iron Works, Inc.
Tool Steel Gear & Pinion Co.
Wellman Engineering Co. McDowell Enterprise

529 SKIPS & CAGES (MINE HOIST) — does not include Buckets, Hoisting & Sinking

CARD IRON WORKS, C. S.
CONNELLSVILLE MFG. & MINE SUPPLY CO.
Coeur d'Alene Hardware & Foundry Co.
Denver Equipment Co.
Easton Car & Construction Co.
Helmick Foundry-Machine Co.
Hirsch Bros. Machy. Co.
Holmes & Bros., Inc. Robert
Lake Shore, Inc. Lake Shore Engineering Div.
Landis Steel Co.
MACHINERY CENTER, INC.
MAYO TUNNEL & MINE EQUIPMENT
Miners' Hardware Supply Co.
NATIONAL IRON CO.
Nolan Co.
Ogden Iron Works
Roberts & Schaefer Co., Subsidiary of Thompson Starrett Co., Inc.
Rogers Iron Works Co.
Sanford-Day Iron Works, Inc
STEARNS ROGER MFG. CO.
Telluride Iron Works Co.
VULCAN IRON WORKS CO. (VULCAN-DENVER)

(SLUSHERS — see: Buckets; Dragline Scraper-Slusher; Hoists, Dragline Scraper-Slusher)

530 SOLVENT EXTRACTION PROCESS EQUIPMENT (SPECIAL)—does not include standard auxiliary equipment

ALLIS-CHALMERS MFG. CO.
Chemical Separations Corp.
Denver Equipment Co.
MIXING EQUIPMENT CO.
Santa Fe Tank Div. Fluor Products Co.
TURBO-MIXER DIV. GENERAL AMERICAN TRANSPORTATION CORP.

531 SPECTROSCOPIC INSTRUMENTS

American Instrument Co., Inc.
American Optical Co.
Bausch & Lomb Optical Co.
Central Scientific Co.
Consolidated Electrodynamics Corp.
Fisher Scientific Co.
Jarrell-Ash Co.
VARIAN ASSOCIATES

(SPEED REDUCERS & INCREASERS—see Drives)

(SPROCKETS—see Gears)
(STACKERS—see Conveyors; Cranes)

532 STEAM CLEANING EQUIPMENT

Clayton Mfg. Co.
Quick Charge Inc.

533 STEEL (PLATES, SHAPES ETC.) — does not include: Buildings, Prefab; Castings; Drill Steel; Forgings; Fencing; Mine Supports; Pipe); Screen; Tanks; Wire

Alan Wood Steel Co.
Allegheny Ludlum Steel Corp.
AMERICAN BRAKE SHOE CO. AMERICAN MANGANESE STEEL DIV.
BABCOCK & WILCOX CO.
Beall Pipe & Tank Corp.
Bethlehem Pacific Coast Steel Corp.
BETHLEHEM STEEL CO., INC.
Byers Co., A.M.
Carpenter Steel Co.
COLORADO FUEL & IRON CORP.
CRUCIBLE STEEL CO. OF AMERICA
Dominion Steel & Coal Corp., Ltd.
Foster Co., L. B.
Holmes & Bros., Inc. Robert
Industrial Engr. & Construction Co.
Inland Steel Co.
Jessop Steel Co.
JONES & LAUGHLIN STEEL CORP.
Kanawha Mfg. Co.
Kaiser Steel Corp.
Lakeside Bridge & Steel Co.
LUKENS STEEL CO.
Midvale-Heppenstall
Moran Engineering Co.
REPUBLIC STEEL CORP.
Ogden Iron Works
Pittsburgh Steel Co.
Ryerson & Son, Inc., Joseph T.
SHEFFIELD DIV. ARMCO STEEL CORP.
Simonds, Saw and Steel Co.
TENNESSEE COAL & IRON DIV. U. S. STEEL CORP.
U. S. STEEL CORP. COLUMBIA-GENEVA STEEL DIV.
WICKWIRE SPENCER STEEL, DIV. COLORADO FUEL & IRON CORP.
Youngstown Sheet & Tube Co.

534 STEEL, ALLOY (PLATES, SHAPES, ETC.) — does

not include: Castings; Drill Steel; Forgings; Mine Supports; Pipe; Screen; Tanks; Wire

Alan Wood Steel Co.
Allegheny Ludlum Steel Corp.
Alloy Steel Casting Co.
AMERICAN BRAKE SHOE CO. AMERICAN MANGANESE STEEL DIV.
AMERICAN STEEL FOUNDRIES
Atlas Steels, Ltd.
Bethlehem Pacific Coast Steel Corp.
BETHLEHEM STEEL CO., INC.
Byers Co., A. M.
Carpenter Steel Co.
COLORADO FUEL & IRON CORP.
CRUCIBLE STEEL CO. OF AMERICA
Dominion Steel & Coal Corp., Ltd.
Electric Steel Foundry Co.
Jessop Steel Co.
JONES & LAUGHLIN STEEL CORP.
Kaiser Steel Corp.
Kanawha Mfg. Co.
Kellogg Co., M. W.
Kensington Steel Co.
Lakeside Bridge & Steel Co.
LUKENS STEEL CO.
Manganese Steel Forge Co.
Midvale-Heppenstall
Moran Engineering Co.
REPUBLIC STEEL CORP.
Ryerson & Son, Inc., Joseph T.
SHEFFIELD DIV. ARMCO STEEL CORP.
Simonds Saw & Steel Co.
Stulz-Sickles Co.
TENNESSEE COAL & IRON DIV. U. S. STEEL CORP.
U. S. STEEL CORP. COLUMBIA-GENEVA STEEL DIV.
Vanadium-Alloys Steel Co.
WICKWIRE SPENCER STEEL, DIV. COLORADO FUEL & IRON CORP.
Wood Steel Co., Alan
Youngstown Sheet & Tube Co.

(STEEL MINE SUPPORTS & CIRCULAR SETS — see Mine Supports)

535 STEEL, STAINLESS (PLATES, SHAPES, ETC.) — does not include: Castings; Forgings; Mine Supports, Pipe, Screen, Tanks, Wire

Allegheny Ludlum Steel Corp.
BETHLEHEM STEEL CO.
JONES & LAUGHLIN STEEL CORP., STAINLESS STEEL DIV.
CRUCIBLE STEEL CO. OF AMERICA
LUKENS STEEL CO.
NATIONAL TUBE DIV., U. S. STEEL CORP.
REPUBLIC STEEL CORP.
TIMKEN ROLLER BEARING CO., STEEL & TUBE DIV.
U. S. STEEL CORP.

(STOWERS — see Concrete Pumps & Placers)

536 STUD DRIVERS

DuPont de Nemours & Co., E. I.
Remington Arms Co., Inc.
Thor Power Tool Co.

(SULPHUR WELL EQUIPMENT — see Salt & Sulphur)

537 SURVEYING EQUIPMENT & SUPPLIES — also see: Drafting Equipment & Supplies; Transits, Pocket

American Paulin System
Berger & Sons, C. L. Inc.
Black Diamond Spad Co.
Bruning Co., Inc. Charles
Brunsch Instrument Co.
Geo-Optic & Paper Corp.
GEODIMETER CORP.
Geophysical Instrument & Supply Co.
Gurley, W. & L. E.
Kern Instruments, Inc.
Keuffel & Esser Co.
Lafayette Radio Corp.
Post Co., Frederick
Suverkrop Instruments
Warren-Knight Co.
White, Instrument Co., David
WILD HEERBRUGG INSTRUMENTS, INC.

(SURVEYORS — see Contractors)

T

(TABLES—see Separators & Concentrators)

(TACHOMETERS—see Meters, Speed)

538 TANKS, LINED—see below; also see: Coatings; Linings

Aluminum Co. of America
American Hard Rubber Co.
Arrow Tank Co.
Beall Pipe & Tank Corp.
Butler Mfg. Co.
Caldwell Co., W. E.
Denver Equipment Co.
Gates Engrg. Co.
GENERAL AMERICAN TRANSPORTATION CORP.
Goodall Rubber Co.
GOODRICH INDUSTRIAL PRODUCTS CO., B. F.
GOODYEAR TIRE & RUBBER CO.
Graver Tank & Mfg. Co., Div. Union Tank Car Co.
Hauser-Stander Tank Co.
Heil Process Equipment Co.
Kirk & Blum Mfg. Co.
Patterson Foundry & Machine Co.
U. S. RUBBER CO. MECHANICAL GOODS DIV.
YUBA CONSOLIDATED INDUSTRIES, INC., ADSCO DIV. & YUBA MANUFACTURING DIV.

539 TANKS, LINED, SPECIAL METAL

Alco Products, Inc.
Aluminum Co. of America
Ampco Metal Inc.
Arrow Tank Co.
Beall Pipe & Tank Corp.
Beech Aircraft Corp.
Caldwell Co., W. E.
Canadian Locomotive Co., Ltd.
Chattanooga Boiler & Tank Co.
Chicago Bridge & Iron Co.
GENERAL AMERICAN TRANSPORTATION CORP.
Graver Tank & Mfg. Co., Div. Union Tank Car Co.
Hauser-Stander Tank Co.
Heil Process Equipment Co.
Kirk & Blum Mfg. Co.
Klemp Metal Grating Corp.
National Lead Co.
Patterson Foundry & Machine Co., Div. Ferro Corp.
Process Engineering, Inc.
YUBA CONSOLIDATED INDUSTRIES, INC., YUBA MANUFACTURING DIV.

540 TANKS, LINED, CERAMIC, CONCRETE, GLASS, ETC.

Beall Pipe & Tank Corp.
Butler Manufacturing Co.
Carrier Conveyor Corp.
Heil Process Equipment Co.
Marietta Concrete Corp.
Ogden Iron Works
Patterson Foundry & Machine Co.
Pennsalt Chemicals Corp.
Process Engineering, Inc.
Smith Co., A. O.

541 TANKS, LINED, PLASTIC OR RUBBER

American Hard Rubber Co.
Arrow Tank Co.
Atlantic Tank Corp.
Beall Pipe & Tank Corp.
Booth Co.
Butler Mfg. Co.
Caldwell Co., W. E.
Canadian Locomotive Co., Ltd.
Chattanooga Boiler & Tank Co.
Denver Equipment Co.
EIMCO CORP.
Galigher Co.
Gates Engrg. Co.
GENERAL AMERICAN TRANSPORTATION CORP.
Goodall Rubber Co.
GOODRICH INDUSTRIAL PRODUCTS CO., B. F.
GOODYEAR TIRE & RUBBER CO.
GOODYEAR TIRE & RUBBER CO. INDUSTRIAL PRODUCTS
Graver Tank & Mfg. Co., Div. Union Tank Car Co.
Hauser Stander Tank Co.
Heil Process Equipment Co.
Kirk & Blum Mfg. Co.
LINATEX CORP. OF AMERICA
Luzerne Rubber Co.
Marietta Concrete Corp.
Patterson Foundry & Machine Co., Div. Ferro Corp.
Process Engineering, Inc.
Schneible Co., Claude B.
STEARNS ROGER MFG. CO.
U. S. RUBBER CO. MECHANICAL GOODS DIV.
Yaun Mfg. Co., Inc.

542 TANKS, STEEL — also see Bins

Beall Pipe & Tank Corp.
BETHLEHEM STEEL CO., INC.
Black, Sivalls & Bryson, Inc.
Bodinson Manufacturing Co., Inc.
Butler Manufacturing Co.
Caldwell Co., W. E.
Canadian Locomotive Co., Ltd.
Chattanooga Boiler & Tank Co.
Chicago Bridge & Iron Co.
Cochrane Corp.
Columbian Steel Tank Co.
Condenser Service & Engineering Co.
CONNELLSVILLE MFG. & MINE SUPPLY CO.
Daniels Co. Contractors, Inc.
Denver Equipment Co.
Dominion Steel & Coal Corp., Ltd.
Engineered Equipment Inc.
Enterprise Wheel & Car Corp.
Erie Strayer Co.
GENERAL AMERICAN TRANSPORTATION CORP.
Graver Tank & Mfg. Co., Div. Union Tank Car Co.
Heil Co.
Holmes & Bros., Inc. Robert
Industrial Engrg. & Construction Co.
Irwin-Sensenich Corp.
Johnson Co., C. S.
Kaiser Steel Corp., Fabricating Div.
Kanawha Mfg. Co.
Keeler Co., E.
Kirk & Blum Mfg. Co.
Lakeside Bridge & Steel Co.
Mahon Co., R. C.
Ogden Iron Works
Ottumwa Box Car Loader Co.
Process Engineering, Inc.
Schneible Co., Claude B.
Sun Shipbuilding & Dry Dock Co.
STEARNS ROGER MFG. CO.
TREADWELL CO., M. H.
VULCAN IRON WORKS CO. (VULCAN-DENVER)
Wellman Engineering Co.
Wheeler Mfg. Co., C. H.
Yaun Mfg. Co., Inc.
YUBA CONSOLIDATED INDUSTRIES, INC., YUBA MANUFACTURING DIV.

543 TANKS, WOOD — also see Bins

Acme Tank Mfg. Co.
Arrow Tank Co.
Atlantic Tank Corp.
Black, Sivalls & Bryson, Inc.
Caldwell Co., W. E.
Denver Equipment Co.
Hall & Sons, Amos H.
Hauser-Stander Tank Co.
Morse Bros. Machinery Co.
National Tank & Pipe Co.
Pacific Wood Tank Corp.
Santa Fe Tank Div. Fluor Products Co.
Stulz-Sickles Co.
Windeler Co., Ltd., George

(TANK LEVEL INDICATORS —see: Bin & Tank Level Indicators)

544 TARPAULINS & TENTING

AMERICAN BRATTICE CLOTH CORP.
Daniels, Inc., C. R.
Gering Products, Inc.
GOODRICH INDUSTRIAL PRODUCTS CO., B. F.
Irvington Div. Minnesota Mining & Mfg. Co.
Parker Safety Equipment Co.
Paulsen-Webber Cordage Corp.
Pickard Industries, Inc. Central Mine Supply Co., Div.
Safety Clothing & Equipment Co.
Synder & Son, Inc., M. L.
Turner Halsey Co.
West Virginia Pulp & Paper Co.-Multiwall Bag Div.

(TELEPHONES— see Communications)

(TELEVISION— see Communications)

(THERMOMETERS & THERMOCOUPLES — see Meters Temperature)

546 THICKENERS—also see: Classifiers; Filters; Separators; Screens

Dagley Mfg. Co.
Denver Equipment Co.
DIESEL ENERGY CORP.
DORR-OLIVER, INC.
EIMCO CORP.
Graver Water Conditioning Co.
HARDINGE CO., INC.
Heyl & Patterson, Inc.
Hirsch Bros. Machy. Co.
INFILCO, INC.
KENNEDY-VAN SAUN MFG. & ENGR. CORP.
LINK-BELT CO.
MACHINERY CENTER INC.
Morse Bros. Machinery Co.
PERMUTIT CO., DIV. PFAUDLER PERMUTIT, INC.
Shriver & Co., T.
WEMCO, DIV. WESTERN MACHINERY CO.

(TIMBER CONNECTORS, SPECIAL—does not include Fasteners)

547 TIMBER FRAMING MACHINES

Denver Equipment Co.
STEARNS ROGER MFG. CO.
Timber Engineering Co.

548 TIMBER PRESERVATIVES

Baxter & Co., J. H.
C—A Wood Preserver Co.
Carbolineum Wood Preserving Co.
Coal Chem. Div., U. S. Steel Corp.
Darworth, Inc.
DOW CHEMICAL CO.
DuPont de Nemours & Co., E. I.
Koppers Co., Inc.
Osmose Wood Preserving Co.
Quigley Co., Inc.
Reilly Tar & Chemical Corp.
STANDARD OIL CO., OF CALIF., WESTERN OPERATIONS, INC.

549 TIMBERINGMACHINES

Fletcher & Co., J. H.
GOODMAN MFG. CO.

550 TIRES & TUBES

Armstrong Rubber Co.
FIRESTONE TIRE & RUBBER CO.
GATES RUBBER CO.
GOODRICH CO., B. F. TRUCK & BUS TIRE DEPT.
GOODRICH INDUSTRIAL PRODUCTS CO., B. F.
GOODYEAR TIRE & RUBBER CO.
GOODYEAR TIRE & RUBBER CO., INDUSTRIAL PRODUCTS
Seiberling Rubber Co.
U. S. RUBBER CO.

551 TOOLS, HAND, & HAND-HELD POWER TOOLS — does not include: Car Derailers & Rerailers; Car Movers, Hand; Hoists, Lift, Hand Chain; Jacks; Rail Benders; Track Gage-Rods & Levels; Shop Equipment, Powered (Lathes, etc.); Lubricating Equipment; Car Wheel & Gear Pullers; Concrete Placers; Kiln & Industrial Guns; Stud Drivers; Rail Drills & Punches; Timbering Machines; Geologist's

Equip.; Welding & Cutting Equip.; Burners; Instruments; Meters & Gages

Ames Co., O.
Ampco Metal, Inc.
Beryllium Corp.
Black & Decker Mfg. Co.
BRUNNER & LAY, INC.
Burndy Corp.
CHICAGO PNEUMATIC TOOL CO.
Cleco Div., Reed Roller Bit Co.
Dicke Tool Co.
DuPont de Nemours & Co., Inc.
Electric Materials Co.
GARDNER-DENVER CO.
General Steel Warehouse Co., Inc.
Glensco Tool Div.
Gibraltar Equipment & Mfg. Co.
Graybar Elec. Co., Inc.
Greene, Tweed & Co.
Herold Mfg. Co.
Ideal Industries, Inc.
INGERSOLL-RAND CO.
Interstate Drop Forge Co.
Leavitt Machine Co.
Leetonia Tool Co.
Long Co.
Milwaukee Electric Tool Corp.
Nelson Stud Welding
Newcomer Products, Inc.
Owatonna Tool Co.
Patton Mfg. Co., Inc.
Pickard Industries, Inc. Central Mine Supply Co., Div.
Porter-Cable Machine Co.
Proto Tool Co.
Remington Arms Co., Inc.
RIDGE TOOL CO.
Simonds Saw and Steel Co.
Skookum Co., Inc.
Snap-on-Tools Corp.
Stanley Electric Tool Div. Stanley Works
Star Expansion
Swett Iron Works, A. L.
Syntron Co.
Thor Power Tool Co.
Toledo Pipe Threading Machine Co.
U. S. Electrical Tool Co.
VULCAN IRON WORKS CO. (VULCAN-DENVER)
Willey's Carbide Tool Co.
Wodack Electric Tool Corp.
Wood Shovel & Tool Co.
Wright Power Saw & Tool Corp. Subsidiary of Thomas Industries

(TOOLS, POWER—see above or Shop Equipment)

(TORQUE CONVERTERS — see Drives)

(TOWERS, EXTENSIBLE & MOBILE—see Booms)

(TRACK—see below; also see Rail)

552 TRACK CLEANING MACHINES

AMERICAN MINE DOOR CO.
ATHEY PRODUCTS CORP.
Frank, M. K.
HOUGH CO., FRANK G.
NORDBERG MFG. CO.
Pettibone Mulliken Corp.

553 TRACK GAGE-RODS & LEVELS

Aldon Co.
Coover Railroad Track Brace Co.
Foster Co., L. B.
Frank, M. K.
Gibraltar Equipment & Mfg. Co.
NORDBERG MFG. CO.

554 TRACK SHIFTER, LAYING & OTHER MACHINES

Frank, M .K.
NORDBERG MFG. CO.
Templeton, Kenly & Co.

555 TRACTORS, CRAWLER

ALLIS-CHALMERS MFG. CO.
CASE CO., J. I.
CATERPILLAR TRACTOR CO.
EIMCO CORP.
EUCLID DIV. GENERAL MOTORS CORP.
HOUGH CO., FRANK G.
INTERNATIONAL HARVESTER EXPORT CO.
JOY MFG. CO.
MACHINERY CENTER, INC.
Oliver Corp.
Schroeder Brothers Corp.

556 TRACTORS, WHEELED — does not include Truck Tractors; also see Car Movers

ALLIS-CHALMERS MFG. CO.
American Coleman Co.
AUTOCAR DIV., WHITE MOTOR CO.
Baker Industrial Trucks, Div. Otis Elevator Co.
CASE CO., J. I., INDUSTRIAL DIV.
CATERPILLAR TRACTOR CO.
DEERE CO., JOHN
Easton Car & Construction Co.
FWD Corp.
HOUGH CO., FRANK G.
INTERNATIONAL HARVESTER EXPORT CO.
Kersey Mfg. Co., Inc.
LE TOURNEAU-WESTINGHOUSE CO.
LeTourneau, Inc., R. G.
Napco Industries Inc.
Oliver Corp.
Pettibone Mulliken Corp.
Sheppard Co., Inc., R. H.
Silent Hoist & Crane Corp.
TRACTOMOTIVE CORP.
Westinghouse Air Brake Co.

557 TRACTOR ATTACHMENTS—also see Loaders

ALLIS-CHALMERS MFG. CO.
American Tractor Equipment Corp.
Anthony Co.
Arrow Mfg. Co.
Ateco Div. Greenville Steel Car Co.
Balderson Inc.
CASE CO., J. I. INDUSTRIAL DIV.
CATERPILLAR TRACTOR CO.
CLARK EQUIPMENT CO. CONSTRUCTION MACHINERY DIV.
Drott Mfg. Co.
EIMCO CORP.
Electric Steel Foundry Co.
Gar Wood Industries, Inc.
Hales Co., W. M.
HOUGH CO., FRANK G.
Hyster Co.
INTERNATIONAL HARVESTER EXPORT CO.
JOY MFG. CO.
LE TOURNEAU-WESTINGHOUSE CO.
MACHINERY CENTER INC.
MOBILE DRILLING, INC.
Oliver Corp.
Preco, Inc.
Skookum Co., Inc.
TRACTOMOTIVE CORP.
Westinghouse Air Brake Co.

558 TRACTOR & EARTH-MOVING EQUIPMENT WEAR - REPLACEMENT PARTS

Allied Steel & Tractor Products, Inc.
ALLIS-CHALMERS MFG. CO.
Alloy Steel & Metals Co.
AMERICAN BRAKE SHOE CO. AMERICAN MANGANESE STEEL DIV.
CASE CO., J. L. INDUSTRIAL DIV.
CATERPILLAR TRACTOR CO.
Columbia Steel Casting Co., Inc.
Continental Copper & Steel Industries Inc. Wooldridge Div.
EIMCO CORP.
Electric Steel Foundry Co.
Frog, Switch & Mfg. Co.
Gar Wood Industries, Inc.
Gatke Corp.
EUCLID DIV. GENERAL MOTORS CORP.
Hales Co., W. M.
Industrial Overlay Metals, Inc.
Interstate Equipment Corp.
Kensington Steel Div., Poor & Co.
LE TOURNEAU-WESTINGHOUSE CO.
MACHINERY CENTER INC.
Oliver Corp.
Rockwell Spring & Axle Co. Timken-Detroit Axle Div.
Sorel Steel Foundries, Ltd.
Sterling Steel Casting Co.
Thew Shovel Co.
Tool Steel Gear & Pinion Co.
U. S. RUBBER CO.
Wellman., S. K.

559 TRAILERS & WAGONS FOR MOTORTRUCK & TRACTOR — also see: Scrapers; Trucks & Trailers, Special Self-Loading

ALLIS-CHALMERS MFG. CO. CONSTRUCTION MACHY. DIV.
Anthony Co.
Arrow Mfg. Co.
ATHEY PRODUCTS CORP.
Beall Pipe & Tank Corp.
C & D DIV. YUBA CONSOLIDATED INDUSTRIES, INC.
Cline Truck Co.
Continental Copper & Steel Industries Inc. Wooldridge Div.
Easton Car & Construction Co.
Enterprise Wheel & Car Corp.
EUCLID DIV. GENERAL MOTORS CORP.
F. A. B. Mfg. Co.
Fairbanks Co.
FWD Corp.
Fruehauf Trailer Co.
Gramm Trailer Corp.
HENDRICKSON MFG. CO.
Heil Co., TEC Div.
INTERNATIONAL HARVESTER EXPORT CO.
Irwin-Sensenich Corp.
KW-DART TRUCK CO.
LE TOURNEAU-WESTINGHOUSE CO.
MAXI CORP.
ROGERS BROTHERS CORP.
Salem-Brosius, Inc.
Schonrock Mfg. Co.
Truck Engineering Corp.
Winter Weiss Co.
YUBA CONSOLIDATED INDUSTRIES, INC., YUBA MANUFACTURING DIV.

560 TRAMP IRON DETECTORS

ASEA ELECTRIC INC.
Dings Magnetic Separator Co.
General Equipment & Mfg. Co.
INDUSTRIAL PHYSICS & ELECTRONICS CO.

561 TRANSITS, POCKET

AINSWORTH & SONS, WILLIAM
Bruning Co., Inc. Charles
Engineers Syndicate. Ltd.
Geo-Optic & Paper Corp.
Geophysical Instrument & Supply Co.
Keuffel & Esser Co.
Suverkrop Instruments

(TRANSMISSIONS—see Drives)

(TRAPS—see Pipeline Traps)

(TROLLEY (ELECTRICAL HAULAGE) ACCESSORIES—see Electric Trolley Accessories)

562 TRUCKS (MOTOR) & TRUCK TRACTORS — also see below and: Scrapers; Trailers

American Coleman Co.
AUTOCAR DIV., WHITE MOTOR CO.
Chrysler Corp. Dodge Truck Div.
Cline Truck Co.
Continental Copper & Steel Industries Inc. Wooidridge Div.
EUCLID DIV. GENERAL MOTORS CORP.
F. A. B. Mfg. Co.
FWD Corp.
Federal Motor Truck Div. Napco Industries Inc.
FORD MOTOR CO.
Getman Brothers
HENDRICKSON MFG. CO.
INTERNATIONAL HARVESTER CO. MOTOR TRUCK DIV.
INERNATIONAL HARVESTER EXPORT CO.
Koehring Div. of Koehring Co.
KW-DART TRUCK CO.
LE TOURNEAU-WESTINGHOUSE CO.
MACK TRUCKS, INC.
Marmon-Herrington Co.
MAXI CORP.
Oshkosh Motor Truck, Inc.
Prime Mover Co.
REO DIV., WHITE MOTOR CO.
Walter Motor Truck Co.
Westinghouse Air Brake Co.
Willys Motors, Inc.

563 TRUCKS, LIFT, FORK & PLATFORM

ALLIS-CHALMERS MFG. CO.
AMERICAN PULLEY CO.
Baker Industrial Trucks, Div. Otis Elevator Co.
Easton Car & Construction Co.
FWD Corp.
Hyster Co.
Qwik-Mix Co., Koehring Div.
Lamson Corp.
LeTourneau, Inc., R. G.
MACHINERY CENTER INC.
Oliver Corp.
Pettibone Mulliken Corp.
Prime Mover Co.
Silent Hoist & Crane Corp.
Uhrden, Inc.
Yale & Towne Mfg. Co. Yale Materials Handling Div.

564 TRUCKS, SHUTTLE CAR & BUGGIE TYPE

ATLAS CAR & MFG. CO.
ATLAS COPCO
Easton Car & Construction Co.
Electric Steel Foundry Co.
Enterprise Wheel & Car Corp.
Getman Brothers
GOODMAN MFG. CO.
Herold Mfg. Co.
Irwin-Sensenich Corp.
JEFFREY MFG. CO.
JOY MFG. CO.
Koehring Div. of Koehring Co.
KW-DART TRUCK CO.
NATIONAL MINE SERVICE CO.
Prime Mover Co.
Salem-Brosius, Inc.
YUBA CONSOLIDATED INDUSTRIES, INC., YUBA MINING DIV.

565 TRUCKS & TRAILERS, SPECIAL SELF-LOADING—does not include Scrapers or units with load moving devices alone

ATLAS COPCO
Baker Industrial Trucks, Div, Otis Elevator Co.
Sanford Day Iron Works

(TRUCK TRAILERS — see Trailers)

566 TRUCK & TRAILER BODIES

Anthony Co.
ATHEY PRODUCTS, CORP.
Beall Pipe & Tank Corp.
Butler Manufacturing Co.
Cline Truck Co.
Dorsey Trailers
Easton Car & Construction Co.
Enterprise Wheel & Car Corp.
Fruehauf Trailer Co.
Gallon Allsteel Body Co.
Gar Wood Industries, Inc.
Gramm Trailer Crop.
Heil Co., Tec Div.
Hercules Steel Products Co.
Hockensmith Corp.
INTERNATIONAL HARVESTER CO., MOTOR TRUCK DIV.
INTERNATIONAL HARVESTER EXPORT CO.
Landis Steel Co.
Marlon Metal Products Co.
Schonrock Mfg. Co.
Transport Trailers, Inc.
Winter Weiss Co.

(TRUCK & TRAILER DUMPING DEVICES—see Car (& Truck) Dumping Devices)

(TURBINES—see Engines)

U

567 ULTRAVIOLET LIGHTS

BALL BROS. RESEARCH CORP.
Carpco Manufacturing Inc.
Detectron Corp.
Engineers Syndicate, Ltd.
Fisher Research Laboratory, Inc.
Geophysical Instrument & Supply Co.
Macbeth Daylighting Corp.
Menlo Research Laboratory
VARIAN ASSOCIATES
Ultra-Violet Products, Inc.
WESTINGHOUSE ELECTRIC CORP.
Whites Electronics

568 UNLOADERS, R. R., CAR & TRUCK

ALLIS-CHALMERS MFG. CO.

BARBER-GREENE CO.
Convair, Inc.
DRAVO CORP.
Easton Car & Construction Co.
Erie Strayer Co.
Frank M. K.
GENERAL AMERICAN TRANSPORTATION CORP.
HEWITT-ROBINS, INC.
Heyl & Patterson, Inc.
HOUGH CO., FRANK G.
JEFFREY MFG. CO.
LINK-BELT CO.
Lippmann Engineering Works, Inc.
McKiernan-Terry Corp., Mead Morrison Div.
Oliver Corp. A. B. Farquhar Div.
Pettibone Mulliken Corp.
Richardson Scale Co.
Stephens-Adamson Mfg. Co.
Webster Mfg., Inc.

V

569 VALVES

Alco Products, Inc.
ALLEN-SHERMAN-HOFF PUMP CO.
ALLIS-CHALMERS MFG. CO.
American Chain & Cable Co., Inc. R-P&C Valve Div.
American Hard Rubber Co.
American Instrument Co., Inc.
Anker-Holth Div., Wellman Engineering Co.
Automatic Switch Co.
Bailey Meter Co.
Barksdale Valves
Barrett Haentjens & Co.
B-I-F Industries, Inc.
Black, Sivalls & Bryson, Inc.
Bristol Co.
Cash Co., A. W.
Clark Controller Co.
Clarkson Co.
Cochrane Corp.
Conrader Co., Inc., R.
Corning Glass Works, Plant Equipment Dept.
CRANE CO.
Crosby Valve & Gage Co.
Cutler-Hammer, Inc.
Darling Valve & Mfg. Co.
Davis Foundry & Machine Works
DEZURIK CORP.
Dick Co., R. & J.
Dixon Valve & Coupling Co.
Duriron Co., Inc.
Edward Valves, Inc.
Electric Steel Foundry Co.
Elkhart Brass Mfg. Co., Inc.
Everlasting Valve Co.
Fairbanks Co.
Falcon Alarm Co., Inc.
FARRIS FLEXIBLE VALVE CORP.
Fisher & Porter Co.
Foster Co., L. B.
Foxboro Co.
Gallagher Co.
Galland Henning Mfg. Co. Nopak Div.
Golden-Anderson Valve Specialty Co.
GOODRICH INDUSTRIAL PRODUCTS CO., B. F.
Goyne Pump Co.
GRINNELL CO., INC.
Hamer Valves, Inc.
HEWITT-ROBINS, INC.
Hills-McCanna Co.
HOSE ACCESSORIES CO.
Hunt & Son, Inc., C. B.
JENKINS BROS.
Johnson Corp.
Kennedy Valve Mfg. Co.
Keystone Valve Corp.
Kieley & Mueller, Inc.
Klipfel Valves, Inc.
Kobe, Inc.
Kraloy Plastic Pipe Co., Inc.
Ladish Co., Hasco Div.
Ledeen, Inc.
LE-HI DIV. HOSE ACCESSORIES CO.
LINATEX CORP. OF AMERICA
Lonergan Co., J. E.
Lunkenheimer Co.
Luzerne Rubber Co.
McDonald Mfg. Co., A. Y.
McNALLY PITTSBURG MFG. CORP.
Meckum Engineering, Inc.
MINNEAPOLIS-HONEYWELL REGULATOR CO. INDUSTRIAL DIV.
MINE & SMELTER SUPPLY CO., MFG. DIV.
Mission Mfg. Co.
Mueller Brass Co.
National Lead Co.
Ohio Brass Co.
Ohio Injector Co.
Oilgear Co.
Okadee Co.
OPW-Jordan, Div. OPW Corp.
Penborthy Mfg. Co.
Pennsylvania Pump & Compressor Co.
Pickard Industries, Inc. Central Mine Supply Co., Div.
Plumbing Products Div., Zurn Industries, Inc.
Powell Co., Wm.
RED JACKET CO., INC.
Republic Flow Meters Co.
Rockwell Mfg. Co., Nordstrom Valve Div.
Rockwell Co., W. S.
Stockham Valves & Fittings
Tube Turns Plastics, Inc.
U. S. RUBBER CO.
U. S. RUBBER CO. MECHANICAL GOODS DIV.
Vickers Inc.
Walworth Co.
Weatherhead Co. Fort Wayne Div.
Wellman Engineering Co.
WESTERN PRECIPITATION CORP.
Westinghouse Air Brake Co., Ind. Products Div.
Weston Electrical Instrument Corp. Subsidiary of Daystrom, Inc.
Wilkerson Corp.
Yarnall-Waring Co.

570 VALVE OPERATING MECHANISMS — does not include Controls

Bailey Meter Co.
Bristol Co.
Cash Co., A. W.
Darling Valve Mfg. Co.
DE ZURIK CORP.
Falcon Alarm Co., Inc.
Foxboro Co.
Kieley Mueller, Inc.
Ledeen, Inc.
Limitorque Corp.
MINNEAPOLIS-HONEYWELL REGULATOR CO.
Ohio Injector Co.
Okadee Co.
PHILADELPHIA GEAR WORKS
Republic Flow Meters Co.
Wheeler Mfg. Co., C. H.
Wilkerson Corp.

571 VENTILATION TUBING, NON-METALLIC — does not include Pipe, Ventilation

Acme Rubber Mfg. Co.
AMERICAN BRATTICE CLOTH CORP.
Arrowhead Products, Div. Federal-Mogul-Bower Bearings, Inc.
BEMIS BRO. BAG. CO.
DuPont de Nemours & Co., E. I.
DuPont de Nemours Co., E. I. Explosives Dept.
DuPont de Nemours Co., Inc. E. I. Fabrics Div.
Flexaust Co.
Flexible Tubing Co.
HAMILTON RUBBER MFG. CORP.
U. S. RUBBER CO. MECHANICAL GOODS DIV.

572 VIBRATORS & VIBRATING MECHANISMS — also see: Car Shakers; Screen Eccentrics

Bin-Dicator Co.
Branford Co.
CLEVELAND VIBRATOR CO.
Davis Foundry & Machine Works
DIESEL ENERGY CORP.
Erlez Mfg. Co.
Hack Engineering Co.
HEWITT-ROBINS, INC.
JEFFREY MFG. CO.
Lecco Machinery & Engineering Co.
LINK-BELT CO.
Lippmann Engineering Works, Inc.
Martin Engineering Co.
Productive Equipment Corp.
Remington Arms Co., Inc.
Southwestern Industrial Electronics Co.
Syntron Co.
TYLER CO., W. S.
Universal Dredge Mfg. Co.
Viber Co.

W

(WAGON DRILLS—see Drills)

(WASHERS, MINERAL LOG, PUG, ETC.)—see Scrubbers)

573 WASHING PLANTS, SAND & GRAVEL, COMPLETE, MOBILE & PORTABLE

BALDWIN-LIMA-HAMILTON CORP. CONSTRUCTION EQUIPMENT DIV.
Bodinson Manufacturing Co., Inc.
Daniels Co. Contractors, Inc.
Davis Foundry Machine Works
Denver Equipment Co.
Diamond Iron Works Div. Goodman Mfg. Co.
Eagle Iron Works
Fuel Process Co.
Hack Engineering Co.
Heyl & Patterson, Inc.
IOWA MFG. CO.
Lipmann Engineering Works, Inc.
McLANAHAN & STONE CORP.
Meckum Engineering, Inc.
Pioneer Engineering Div. Poor & Co. Inc.
Rogers Iron Works Co.
Smith Engineering Works
Universal Dredge Mfg. Co.
Universal Engineering Corp.
Universal Road Machinery Co.
Washington Machinery Co.
WESTERN MACHINERY CO.
YUBA CONSOLIDATED INDUSTRIES, INC., YUBA MINING DIV.

574 WATER CLARIFICATION & TREATMENT EQUIPMENT—also see Ion Exchange

ALLIS-CHALMERS MFG. CO.
American Water Softener Co.
American Well Works
B-I-F Industries, Inc.
Bird Machine Co.
Brosites Products Corp.
Builders-Providence Div. B-I-F Industries
Chain Belt Co.
Christian Engineers, J. D.
Cochrane Corp.
Daniels Co. Contractors, Inc.
Denver Equipment Co.
DORR-OLIVER, INC.
EIMCO CORP.
Electronics Div., Diamond Power Specialty Corp.
Enley Products, Inc.
Fischer & Porter Co.
Graver Water Conditioning Co.
Hagan Chemicals & Controls, Inc. Divisions: Calgon Co., Hall Laboratories
HARDINGE CO., INC.
Heyl & Patterson, Inc.
INFILCO, INC.
Ionics, Inc.
JEFFREY MFG. CO.
Kanawha Mfg. Co.
Leeds & Northrup Co.
LINK-BELT CO.
PERMUTIT CO., DIV. PFAUDLER PERMUTIT INC.
Peterson Filters & Engr. Co.
Shriver & Co., T.
Taylor & Co., W. A.
WEMCO, DIV. WESTERN MACHINERY CO.
Zurn Mfg., J. A., Div. Zurn Industries Inc.

575 WATER CLARIFICATION & TREATMENT —does not inslude Ion Exchange Resins

ALLIS-CHALMERS MFG. CO.
AMERICAN CYANAMID CO.
ARMOUR CHEMICAL DIV.
Butler Bin Co.
Canadian Industries Ltd.
Cochrane Corp.
CYANAMID INTERNATIONAL, MINING CHEMICALS DEPT.
DOW CHEMICAL CO.
DuPont de Nemours & Co., E. I.
Food Machinery & Chemical Corp. Westvaco Mineral Products Div. Westvaco Chlor-Alkali Div.
GENERAL CHEMICAL DIV., ALLIED CHEMICAL CORP.
GOODRICH, B. F. CO.
Hagan Chemicals & Controls, Inc. Divisions: Calgon Co., Hall Laboratories
HERCULES POWDER CO.
Marathon Corp. Chemical Sales Dept.
Michigan Chemical Corp.
Monsanto Chemical Co.
Pacific Lumber Co.
Pennsalt Chemicals Corp.
PERMUITT CO., DIV. PFAUDLER PERMUTIT INC.
Pettinos, Inc., Geroge F.
PHILADELPHIA QUARTZ CO.
Plumbing Products Div., Zurn Industries, Inc.
Stein, Hall & Co., Inc.
Union Carbide Chemicals Co., Union Carbide Corp.
Van Waters & Rogers, Inc.
West Virginia Pulp & Paper Co.
Wyandotte Chemicals Corp.

(WEIGH HOPPERS — see Scales)

576 WELDING & CUTTING EQUIPMENT—also see Metallizing Equipment

Air Reduction Sales Co., Div. Air Reduction Co., Inc.
ALLOY RODS CO.
AMERICAN BRAKE SHOE CO. AMERICAN MANAGANESE STEEL DIV.
CATERPILLAR TRACTOR CO.
Daniels, Inc., C. R.
Eisler Engineering Co.
Gar Wood Industries, Inc.
HARNISCHFEGER CORP.
Hobart Bros. Co.
Industrial Air Products Co.
Industrial Overlay Metals, Inc.
Kaiser Aluminum & Chemical Sales, Inc.
Kurz & Root Co.
Lincoln Electric Co.
Linde Co. Union Carbide Corp.
Marquette Mfg. Co., Inc.
Metal & Thermit Corp.
National Cylinder Gas
Ohio Brass Co.
Parker Safety Equipment Co.
Phoenix Products Co.
Ray-O-Vac Co., Div. Electric Storage Battery Co.
Ready Power Co.
Sellstrom Mfg. Co.
Sight Feed Generator Co.
Smith Co., A. O.
Smith Welding Equipment Corp.
Tweco Products, Inc.
Universal Electric Sales Corp.
VICTOR EQUIPMENT CO., ALLOY ROD & METAL DIV.
Wall Colmony Corp.
WESTINGHOUSE ELECTRIC CORP.
Worthington Corp.

577 WELDING RODS, ELECTRODES, SOLDER, ETC. see Metallizing Equipment

Air Reduction Sales Co., Div. Air Reduction Co., Inc.
All-State Welding Alloys Co., Inc.
ALLOYS RODS CO.
AMERICAN BRAKE SHOE CO. AMERICAN MANGANESE STEEL DIV.
American Brass Co.
American Chain & Cable Co., Inc. Page Steel & Wire Div.
Ampco Metal, Inc.
Arcos Corp.
Charles Engelhard, Inc.
Coast Metals, Inc.
Eisler Engineering Co.
Eutectic Welding Alloys Corp.
Gibralter Equipment & Mfg. Co.
HARNISCHFEGER CORP.
Haynes Stellite Co. Div. Union Carbide Corp.
Hobart Bros. Co.
Industrial Air Products Co.
Industrial Overlay Metals, Inc.
INTERNATIONAL NICKEL CO.
Lincoln Electric Co.
Linde Co. Union Carbide Corp.
LUKENS STEEL CO.
Marquette Mfg. Co., Inc.
Metal & Thermit Corp.
Mueller Brass Co.
National Carbon Co. Div. Union Carbide Corp.
National Cylinder Gas
Ohio Carbon Co.
Pickard Industries, Inc. Central Mine Supply Co., Div.
Pure Carbon Co.
Revere Copper & Brass, Inc.
SHEFFIELD DIV. ARMCO STEEL CORP.
Sight Feed Generator Co.
Smith Co., A. O.
Stackpole Carbon Co.
STOODY CO.
Stulz-Sickles Co.
Sylvania Electric Products Inc., Chemical & Metallurgial Div.
Titan Metal Mfg. Co.
U. S. Gauge Div., American Machine & Metal, Inc.
Vanadium-Alloys Steel Co.
VICTOR EQUIPMENT CO. ALLOY ROD & METAL DIV.
WESTINGHOUSE ELECTRIC CORP.

578 WELDMENTS—also see: Bucket Teeth; Castings; Forgings; Tractor Wear-Replacement Parts

Alco Products, Inc.
Allied Steel & Tractor Products, Inc.
AMERICAN BRAKE SHOE CO., AMERICAN MANAGANESE STEEL DIV.
Ampco Metal, Inc.
BLAW-KNOX CO.
Canadian Locomotive Co., Ltd.
Chattanooga Boiler & Tank Co.

COLORADO FUEL & IRON CORP.
CONNELLSVILLE MFG. & MINE SUPPLY CO.
DRESSER MFG. DIV., DRESSER INDUSTRIES, INC.
Enterprise Wheel & Car Corp.
FALK CORP.
Farrel-Birmingham Co., Inc.
Farrell-Cheek Steel Co.
GENERAL AMERICAN TRANSPORTATION CORP.
Graver Tank & Mfg. Co., Div. Union Tank Car Co.
Industrial Air Products Co.
Industrial Overlay Metals, Inc.
Irwin-Sensenich Corp.
Kirk & Blum Mfg. Co.
Kensington Steel Div., Poor Co.
Ladish Co.
Lakeside Bridge & Steel Co.
LUKENS STEEL CO.
Mahon Co., R. C.
Manning, Maxwell & Moore, Inc. Shaw Box Crane & Hoist Div.
Meckum Engineering, Inc.
NATIONAL IRON CO.
NORDBERG MFG. CO.
Page Engineering Co.
Pollock Co., William B.
Sight Feed Generator Co.
Smith Co., A. O.
Sorel Steel Foundries, Ltd.
Stulz-Sickles Co.
Wellman Engineering Co.
Wheeler Mfg. Co., C. H.

579 WINCHES, AIR

AMERICAN HOIST & DERRICK CO.
ATLAS COPCO EASTERN, INC.
ATLAS COPCO PACIFIC, INC.
CHICAGO PNEUMATIC TOOL CO.
GARDNER-DENVER CO.
Holman Bros.—Canada Ltd.
INGERSOLL-RAND CO.
JOY MFG. CO.
Lidgerwood Industries, Inc.
MACHINERY CENTER INC.
Round & Son, Inc., David
Silent Hoist & Crane Corp.

580 WINCHES, DIESEL & GASOLINE

AMERICAN HOIST & DERRICK CO.
CHICAGO PNEUMATIC TOOL CO
Clyde Iron Works, Inc.
Gar Wood Industries, Inc.
Hyster Co.
INGERSOLL-RAND CO.
JOY MFG. CO.
Lidgerwood Industries, Inc.
O. K. Machinery Div. John C. Motter Printing Press Co.
Silent Hoist & Crane Corp.
Stimmel Winch Co., Inc.
Superior-Lidgerwood-Mundy Corp.

581 WINCHES, ELECTRIC

AMERICAN HOIST & DERRICK CO.
Christian Engineers, J. D.
Clyde Iron Works, Inc.
Easton Car & Construction Co.
Electro Lift, Inc.
Gar Wood Industries, Inc.
HARNISCHFEGER CORP.
HEWITT-ROBINS, INC.
INGERSOLL-RAND CO.
JEFFREY MFG. CO.
JOY MFG. CO.
Lidgerwood Industries, Inc.
LINK-BELT CO.
Manning, Maxwell & Moore, Inc. Shaw Box Crane & Hoist Div.
Moran Engineering Co.
O. K. Machinery Div. John C. Motter Printing Press Co.
Pacific Coast Engineering Co.
Reading Crane & Hoist Corp.
Round & Sons, Inc., David
Sanford-Day Iron Works, Inc.
SAUERMAN BROS., INC.
Shepard Niles Crane & Hoist Corp.
Silent Hoist & Crane Corp.
Stephens-Adamson Mfg. Co.
Stimmel Winch Co., Inc.
Superior-Lidgerwood-Mundy Corp.
VULCAN IRON WORKS CO. (VULCAN-DENVER)
Washington Iron Works
WESTINGHOUSE ELECTRIC CORP.
Yale & Towne Mfg. Co.
YUBA CONSOLIDATED INDUSTRIES, INC., YUBA MFG. DIV.

582 WINCHES, HAND—does not include Hoists, Lift, Hand Chain

Bartlett & Snow Co., C. O.
Christian Engineers, J. D.
Griphoist, Inc.
Indiana Foundry Co.
LINK-BELT CO.
Round & Son, Inc., David
Stephens-Adamson Mfg. Co.
Stimmel Winch Co., Inc.
Yale & Towne Mfg. Co.

583 WINCHES, HYDRAULIC

AMERICAN HOIST & DERRICK CO.
AUSTIN - WESTERN CONSTRUCTION EQUIPMENT DIV. BALDWIN-LIMA-HAMILTON CORP.
Lidgerwood Industries, Inc.
Manganese Steel Forge Co.
Manning, Maxwell & Moore, Inc. Shaw Box Crane & Hoist Div.
Moran Engineering Co.
Silent Hoist & Crane Corp.
Star Wire Screen & Iron Works, Inc.
Superior-Ligerwood-Mundy Corp.
Vickers, Inc.

584 WINCHES, PORTABLE & MOVABLE

CHICAGO PNEUMATIC TOOL CO.
Christian Engineers, J. D.
JOY MFG. CO.
Sanford-Day Iron Works, Inc.
Stimmel Winch Co., Inc.

585 WINCHES, STATIONARY

Christian Engineers, J. D.
JOY MFG. CO.
LINK-BELT CO.
Sanford-Day Iron Works, Inc.
Stimmel Winch Co., Inc.

586 WIRE CLOTH

Bonded Scale & Machine Co.
Buffalo Wire Works Co.
Cambridge Wire Cloth Co.
Chase Brass & Cooper Co.
COLORADO FUEL & IRON CORP.
HEWITT-ROBINS, INC.
Hoyt Wire Cloth Co.
Ludlow-Saylor Wire Cloth Co.
Multi-Metal Wire Cloth Co., Inc.
Newark Wire Cloth Co.
Pickard Industries, Inc. Central Mine Supply Co., Div.
Pioneer Engineering Div. Poor & Co. Inc
SIMPLICITY ENGINEERING CO.
Southwestern Engineering Co.
Star Wire Screen & Iron Works, Inc.
TYLER CO., W. S.
WICKWIRE SPENCER STEEL DIV., COLORADO FUEL & IRON CORP.

WIRE FENCING — see Fencing

587 WIRE ROPE

American Chain & Cable Co. American Cable Div.
American Chain & Cable Co., Inc. Automotive & Aircraft Div.
American Chain & Cable Co. Hazard Wire Rope Div.
AMERICAN STEEL & WIRE DIV. U. S. STEEL CORP.
Bethlehem Pacific Coast Steel Corp.
BETHLEHEM STEEL CO., INC.
BRODERICK & BASCOM ROPE CO.
Chase Brass & Copper Co.
COLORADO FUEL & IRON CORP.
Electric Steel Foundry Co.
Flocker & Co., John
Hales Co., W. M.
Interstate Equipment Corp.
JONES & LAUGHLIN STEEL CORP.
LESCHEN WIRE ROPE DIV. H. K. PORTER COMPANY, INC.
LE TOURNEAU-WESTINGHOUSE CO.
Macwhyte Wire Rope Co.
NATIONAL MINE SERVICE CO.
Pacific Wire Rope Co.
Paulsen-Webber Cordage Corp.
Pickard Industries, Inc. Central Mine Supply Co., Div.
RIBLETT TRAMWAY CO.
Rochester Ropes, Inc.
ROEBLING'S SONS CORP., JOHN A. SUBSIDIARY OF COLORADO FUEL & IRON CO.
Ryerson & Son, Inc., Joseph T.
SAUERMAN BROS. INC.
TENNESSEE COAL & IRON DIV. U. S. STEEL CORP.
TEXAS CO.
Union Wire Rope Corp., Subsidiary Armco Steel Corp.
U. S. STEEL CORP. COLUMBIA-GENEVA STEEL DIV.
Westinghouse Air Brake Co.
WICKWIRE SPENCER STEEL DIV. COLORADO FUEL & IRON CORP.
Wire Rope Corp. of America, Inc.

(WIRE ROPE DRESSING—see Lubricants)

588 WIRE ROPE FITTINGS

American Chain & Cable Co. American Cable Div.
American Chain & Cable Co. Hazard Wire Rope Div.
AMERICAN HOIST & DERRICK CO.
AMERICAN STEEL & WIRE DIV. U. S. STEEL CORP.
Bethlehem Pacific Coast Steel Corp.
BETHLEHEM STEEL CO., INC.
BRODERICK & BASCOM ROPE CO.
COLORADO FUEL & IRON CORP.
Columbia Steel Casting Co., Inc.
Electric Steel Foundry Co.
Farrell-Cheek Steel Co.
Hales Co., W. M.
Hayes Steel Products, Ltd.
Holmes & Bros., Inc. Robert
Interstate Drop Forge Co.
Interstate Equipment Corp.
JONES & LAUGHLIN STEEL CORP.
Lamson & Sessions Co.
LESCHEN WIRE ROPE DIV. H. K. PORTER COMPANY, INC.
Macwhyte Wire Rope Co.
Madesco Tackle Block Co.
NATIONAL MINE SERVICE CO.
Pacific Wire Rope Co.
Page Engineering Co.
Paulsen-Webber Cordage Corp.
Pickard Industries, Inc. Central Mine Supply Co., Div.
Quay Industries
RIBLET TRAMWAY CO.
Rochester Ropes, Inc.
ROEBLING'S SONS CORP., JOHN A. SUBSIDIARY OF COLORADO FUEL & IRON CO.
Ryerson & Son, Inc., Joseph T.
SAUERMAN BROS., INC.
Skookum Co., Inc.
TENNESSEE COAL & IRON DIV. U. S. STEEL CORP.
Union Wire Rope Corp. Subsidiary of Armco Steel Corp.
WICKWIRE SPENCER STEEL DIV. COLORADO FUEL & IRON CORP.
Wire Rope Corp. of America, Inc.

589 WIRE ROPE SLINGS

American Chain & Cable Co. American Cable Div.
American Chain & Cable Co. Hazard Wire Rope Div.
AMERICAN STEEL & WIRE DIV. U. S. STEEL CORP.
Bethlehem Pacific Coast Steel Corp.
BETHLEHEM STEEL CO., INC.
BRODERICK & BASCOM ROPE CO.
Cambridge Wire Coth Co.
COLORADO FUEL & IRON CORP.
Electric Steel Foundry Co.
Hales Co., W. M.
JONES & LAUGHLIN STEEL CORP.
LESCHEN WIRE ROPE DIV. H. K. PORTER COMPANY, INC.
Macwhyte Wire Rope Co.
McMillan's Sons, W. H.
Pacific Wire Rope Co.
Paulsen-Webber Cordage Corp.
Pickard Industries, Inc. Central Mine Supply Co., Div.
Rochester Ropes, Inc.
ROEBLING'S SONS CORP., JOHN A. SUBSIDIARY OF COLORADO FUEL & IRON CORP.
Ryerson & Son, Inc., Joseph T.
TENNESSEE COAL & IRON DIV. U. S. STEEL CORP.
Union Wire Rope Corp., Subsidiary Armco Steel Corp.
U. S. STEEL CORP. COLUMBIA-GENEVA STEEL DIV.
WICKWIRE SPENCER STEEL DIV. COLORADO FUEL & IRON CORP.
Wire Rope Corp. of America, Inc.

(WIRE SCREEN—see Screen)

(YIELDABLE PROPS & ARCHES — see: Mine Supports)

See the Manufacturers' Index (next page) for addresses of the above list.

The E&MJ

Manufacturers' Index

Use this section:

1) To locate the mailing address of the manufacturer, who will supply more information at your request.

2) To find the advertisement in this issue by the manufacturers whose names are in bold face.
The page number follows the address listing.

A

Abbott, Charles & Associates, 29 West 7th St., New York 23, N. Y.
Abbé Engineering Co., 50 Church St., New York 7, N. Y.
Abrams Aerial Survey Corp., 606 Shiawassee St., Lansing, Mich.
ACF Industries, Inc., American Car & Foundry Div., 30 Church St., N. Y. 7, N. Y.
ACKER DRILL CO., P. O. BOX 830, SCRANTON 2, PA. P412
Ackerman-Johnson Co., 625 Jackson Blvd., Chicago 6, Ill.
Acme Electric Heating Co., 1217 Washington St., Boston 18, Mass.
Acme Machinery Co., P. O. Box 1169, Williamson, W. Va.
Acme Road Machinery Co., Inc., E. Main St., Frankfort, N. Y.
Acme Rubber Mfg. Co., State St., Trenton, N. J.
Acme Tank Mfg. Co., 12,000 E. Washington, Whittier, Calif.
Adamas Carbide Co., 121 Market St., Kenilworth, N. J.
Advance Car Mover Co., Inc., Box 536, Appleton, Wis.
AERO SERVICE CORP., 210 East Courtland St., Philadelphia 20, Pa. P34
Aero Service Corp. (Mid-Continent) 1401 South Detroit St., Tulsa, Okla.
Aero Service Corp. (Western) 35 Richards St., Salt Lake City 10, Utah.
Aero Service Corp. de Venezuela, Apartado 3985, Caracas, Venezuela.
Aerofall Mills, Inc., 1025 W. Third Ave., Columbus 8, Ohio.
Aeroquip Corp., 300 South East Ave., Jackson, Mich.
Aerquip Corp., Western Div., 3015 Winona Ave., Burbank, Calif.
Aetna Ball & Roller Bearing Co. Div., Parkersburg-Aetna Corp., 4600 Schubert Ave., Chicago 39, Ill.
African Surveys (Pty.), Ltd., 44 Nugget St., Johannesburg, Union of South Africa.
Ahlberg Bearing Co., 3025 W. 47th St., Chicago 32, Ill.
AINSWORTH & SONS, WILLIAM, 2151 Lawrence St., Denver 2, Colo. P417
Airdox-Cardox Products Co., 307 N. Michigan Ave., Chicago 1, Ill.
Air Reduction Sales Co., Div., Air Reduction Co., Inc., 150 East 42nd St., New York, N. Y.
Ajax Flexible Coupling Co., Westfield, N. Y.
Alan Wood Steel Co., Conshohocken, Pa.
Albany Felt Co., Albany 1, N. Y.
Alco Products, Inc., Schenectady 5, N. Y.
Aldon Co., 3338 Ravenswood Ave., Chicago 13, Ill.
Aldrich Pump Co., 1 Pine St., Allentown, Pa.
Allegheny Ludlum Steel Corp., Oliver Bldg., Pittsburgh 22, Pa.
Allen-Bradley Co., 136 W. Greenfield Ave., Milwaukee 4, Wis.
ALLEN-SHERMAN-HOFF PUMP CO., 259 E. Lancaster Ave., Wynnewood, Pa., (To Sept. 1st, see Below)
ALLEN-SHERMAN-HOFF PUMP CO., P. O. Box 635, Paoli, Pa. Second Cover
ALLIED CHEMICAL CORP., SOLVAY PROCESS DIV., 61 Brdway, N. Y. 6, N. Y. P192
Allied Steel & Tractor Products, 7835 Broadway, Cleveland 5, Ohio.
ALLIS-CHALMERS MFG. CO., CONSTRUCTION MACHY. DIV., 1126 South 70th St., Milwaukee, Wis. PP38-39
ALLIS-CHALMERS MFG. CO., ENGINE-MATERIAL HANDLING DIV., 1133 S. 70th St., Milwaukee 1, Wis.
ALLIS-CHALMERS MFG. CO., 969 South 70th St., Milwaukee 1, Wis. PP 319, 321, 323, 325, 327
Allis Co., Louis, 427 East Stewart St., Milwaukee 1, Wis.
ALLOY RODS CO., York, Pa. P172
Alloy Steel & Metals Co., P. O. Box 58323, Vernon Station, Los Angeles 58, Calif.
Alloy Steel Casting Co., 204 County Line Rd., Southampton, Pa.
All-State Welding Alloys Co. Inc., 249-55 Ferris Ave., White Plains, N. Y.
Alpha Molykote Corp., 65 Harvard St., Stamford, Conn.
Alphaduct Wire & Cable Co., P. O. Box 709, New Brunswick, N. J.
Aluminum Co. of America 1501 Alcoa Bldg., Pittsburgh 19, Pa.
Amerace Corp., American Hard Rubber Co. Div., Ace Road, Butler, N. J.
AMERCOAT CORP., 4809 Firestone Blvd., South Gate, Calif. P149
AMERICAN AIR FILTER CO., INC., 215 Central Ave., Louisville 8, Ky. PP84-85
American Air Surveys, Inc., 907 Penn Ave., Pittsburgh 22, Pa.
American Brake Shoe Co., Engineered Castings Div., 530 Fifth Ave., New York 30, N. Y.
AMERICAN BRAKE SHOE CO., AMERICAN MANGANESE STEEL DIV., 389 East 14th St., Chicago Heights, Ill.
American Brass Co., Waterbury 20, Conn.
AMERICAN BRATTICE CLOTH CORP., Warsaw, Ind. P420
AMERICAN BRIDGE DIV., U. S. STEEL CORP., 204 Frick Bldg., Pittsburgh 30, Pa.
American Chain & Cable Co., Inc., Bridgeport 2, Conn.
American Chain & Cable Co., American Cable Div., Wilkes-Barre, Pa.
American Chain Div., American Chain & Cable Co., Inc., York, Pa.
American Chain & Cable Co., Inc., Automotive & Aircraft Div., 601 Stephenson Bldg., Detroit 2, Mich.
American Chain & Cable Co., Hazard Wire Rope Div., Wilkes-Barre, Pa.
American Chain & Cable Co., Inc., Page Steel & Wire Div., Monessen, Pa.
American Chain & Cable Co., Inc., R-P&C Valve Di., Reading, Pa.
American Chain & Cable Co., Inc., Wright Hoist Div., York, Pa.
American Coldset Corp., U. S. Highway, Teterboro, N. J.
American Coleman Co., 301 South Nevada, Littleton, Colo.
American Conveyor Co., 2133 S. Christiana Ave., Chicago 23, Ill.
American Crucible Products Co., 1305 Oberlin Ave., Lorain, Ohio.
AMERICAN CYANAMID CO. Building 3, Bound Brook, N. J. PP76-77
American Emery Wheel Works, Richmond Square Providence 1, R. I.
American Flexible Coupling Div., Zurn Industries, Inc., Pittsburgh Ave., Erie, Pa.
American Forge Co., Niles, Calif.
AMERICAN HOIST & DERRICK CO., 63 S. Robert St., St. Paul, Minn P156
American Instrument Co., Inc., 8030 Georgia Ave., Silver Spring, Md.
American Machine & Metals, Inc., De Bothezat Fans Div., East Moline, Ill.
American MARC Inc., 1601 W. Florence, Inglewood, Calif.
American-Marsh Pumps Inc., 60 Capital Ave., Battle Creek, Mich.
AMERICAN METAL CLIMAX INC., CLIMAX MOLYBDENUM CO. DIV., 61 Broadway, New York, N. Y. P324
AMERICAN MINE DOOR CO., 2039 Dueber Ave., S. W. Canton 6, Ohio. P87
American Oil Co., 555 Fifth Ave., New York 17, N. Y.
American Optical Co., Safety Products Div., 14 Mechanic St., Southbridge, Mass.
American Paulin System, 1524 South Flower St., Los Angeles 15, Calif.
PIPE LININGS DIV., AMERICAN PIPE & CONSTRUCTION CO., 2414 E. 223 St., Wilmington, Calif. P370
AMERICAN PULLEY CO., 4200 Wissahickon Ave., Philadelphia 29, Pa. P417
American Pulverizer Co., 1275 Macklin Ave., St. Louis 10, Mo.
American Rectifier Corp., 95 Lafayette St., New York, N. Y.
American Rubber Mfg. Co., 1145 Park Ave., Oakland 8, Calif.
AMERICAN SMELTING & REFINING CO., 120 Broadway, New York 4, N. Y. P389
AMERICAN SMELTING & REFINING CO., FEDERATED METALS DIV., 120 Broadway, New York 4, N. Y. P389
American Spectrographic Laboratories Inc., 557 Minna St., San Francisco, Calif.
American Standard Industrial Div., Detroit 32, Mich.
AMERICAN STEEL FOUNDRIES, Prudential Plaza, Chicago 1, Ill. P177
AMERICAN STEEL & WIRE DIV., U. S. STEEL CORP., Rockefeller Bldg., Cleveland, Ohio. P397
American Tractor Equipment Corp., 9131 San Leandro Blvd., Oakland 3, Calif.
American Water Softener Co., Lehigh Ave. & Fourth St., Philadelphia 33, Pa.
American Well Works, 180 N. Broadway, Aurora, Ill.
Ames Co., O., Parkersburgh, W. Va.
Amers Iron Works, Inc., 25 E. 2nd St., Oswego, N. Y.
Ammann Photogrammetric Engrs., Inc., Jack, 931 Broadway, San Antonio, Texas.
Ampco Metal, Inc., 1739 South 38th St., Milwaukee 46, Wis.
ANACONDA WIRE & CABLE CO., 25 Broadway, New York 4, N. Y. P366-367
Analytical Measurements, Inc., 585 Main St., Chatham, N. J.
Anchor Plastics Co., Inc., 36-36 36th St., Long Island City 6, N. Y.
Anderson Mfg. Co., Albert & J. M. 289 A St., Boston 10, Mass.
Ansonia Wire & Cable Co., 111 Martin St., Ashton, R. I.
Anthony Co., Streator, Ill.
Apache Powder Co., Benson Ariz.
Appleton Electric Co., 1701 Wellington Ave., Chicago 13, Ill.
Arcos Corp., 1500 S. 50th St., Philadelphia 43, Pa.
Arizona Assay Office, 815 N. 1st St., Phoenix, Ariz.
Arizona Testing Laboratories, 817 W. Madison St., Phoenix, Ariz.
Arkansas Fuel Oil Corp., Slattery Bldg., Shreveport 4, La.
Armco Drainage & Metal Products, Inc., 703 Curtis St., Middletown, Ohio.
Armor Electric Mfg. Co., 1020 Holland St., Erie, Pa.
ARMOUR CHEMICAL DIV., 1355 West 31st St., Chicago 9, Ill. P143-144
Armstrong, Bray & Co., 5364 Northwest Hwy., Chicago 30, Ill.
Armstrong Rubber Co., West Haven, Conn.
Arnot-Jamestown, 730 Fifth Ave., New York, New York.
Arrow Hart & Hegeman Electric Co., 103 Hawthorne St., Hartford 6, Conn.
Arrow Mfg. Co., P. O. Box 4120, South Denver Station, Denver 9, Colo.
Arrow Tank Co., 16 Barnett St., Buffalo 15, N. Y.
Arrowhead Products Div., Federal-Mogul-Bower Bearings, Inc., 2300 Curry St., Long Beach 5, Calif.
Arrowhead Steel Buildings, Inc., 1122 W. Railroad St., Duluth 2, Minn.
Asbestos Mfg. Co., Huntington, Inc.
ASEA ELECTRIC, INC., 500 Fifth Ave., New York 36, N. Y. P88
Assembly Products, Inc., Wilson Mills Rd., Chesterland 70, Ohio.
Associated Metals & Minerals Corp., 75 West St., New York 6, N. Y.
Ateco Div., Greenville Steel Car Co., Greenville, Pa.
ATHEY PRODUCTS CORP., 5631 West 65th St., Chicago 38, Ill. P66-67
Atlantic Refining Co., 260 S. Broad St., Philadelphia, Pa.
Atlantic Tank Corp., 1207 Tonnelle Ave., North Bergen, N. J.
ATLAS CAR & MFG. CO., 1140 Ivanhoe Rd., Cleveland 10, Ohio. P412
Atlas Chain & Mfg. Co., P. O. Box 708, West Pittston, Pa.
Atlas Conveyor Co., Clintonville, Wis.
ATLAS COPCO EASTERN INC., 151 Linwood Ave., Paterson 25, N. J. PP350-352
ATLAS COPCO PACIFIC, INC., 930 Brittan Ave., San Carlos, Calif.
ATLAS POWDER CO., Wilmington 99, Del. P79
Atlas Steel Casting Co., 1963 Elmwood Ave., Buffalo 7, N. Y.
Atlas Steels, Ltd., Welland, Ontario, Canada.
AUSTIN - WESTERN CONSTRUCTION EQUIPMENT DIV., BALDWIN-LIMA-HAMILTON CORP., Aurora, Ill. P365
Auto-Lite Battery Corp., Toledo 1, Ohio
AUTOCAR DIV., WHITE MOTOR CO., Exton, Penn. P163
Automatic Electric Co., Northlake, Ill.
Automatic Switch Co., Hanover Rd., Florham Park, N. J.

B

BABCOCK & WILCOX CO., 161 East 42nd St., New York 17, N. Y. PP16, 152, 153
Bacon-Greene & Milroy, 29 Washington Ave., P. O. Box 5276, Hamden, Conn.
Badger Malleable & Mfg. Co., South Milwaukee, Wis.
Bailey Meter Co., 1050 Ivanhoe Rd., Cleveland, Ohio.
Baird-Atomic, Inc., 33 University Road, Cambridge 38, Mass.
BAKER & ADAMSON PRODUCTS, General Chemical Div., Allied Chemical Corp., 40 Rector St., New York 6, N. Y.
Baker Chemical Co., J. T., Phillipsburg, N. J.
Baker Industrial Trucks, Div. Otis Elevator Co., 8000 Baker Ave., N. W., Cleveland 2, Ohio.
Balderson Inc., Wamego, Kan.
Baldor Electric Co., 4351-67 Duncan Ave., St. Louis 10, Mo.
BALDWIN-LIMA-HAMILTON CORP., C Construction Equipment Div., South Main St., Lima, Ohio PP365, 337
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BALDWIN - LIMA - HAMILTON CORP., EDDYSTONE DIV., Philadelphia 42, Pa. P316
BALL BROTHERS RESEARCH CORP., Boulder, Colo. P160
Ballymore Co., Wayne, Pa.
Band-It Co., 48th & Dahlia, Denver 16, Colo.
BARBER-GREENE CO., 400 North Highland Ave., Aurora, Ill. P63
Barksdale Valves, 5125 Alcoa Ave., Los Angeles 58, Calif.
Barnes Mfg. Co., 615 North Main St., Mansfield, Ohio.
Barrett Haentjens & Co., Hazleton, Pa.
Bartlett & Snow Co., C. O., 6200 Harvard Ave., Cleveland 5, Ohio.
Bates Co., Walter, 500 Mills Rd., Joliet, Ill.
Bausch & Lomb Optical Co., Scientific Products Divs., 83759 St. Paul St., Rochester 2, N. Y.

Baxter & Co., J. H., 120 Montgomery St., San Francisco 4, Calif.
Bay City Shovels, Inc., Bay City, Mich.
Bay State Abrasive Products Co., 12 Union St., Westboro, Mass.
Beach-Russ Co., 420 Lexington Ave., New York 17, N. Y.
Beall Pipe & Tank Corp., 12005 N. Burgard St., Portland 3, Ore.
Bechtel Corp., 220 Bush St., San Francisco 4, Calif.
Beckman Instruments, Inc., Berkeley Div., 2200 Wright Ave., Richmond, Calif.
Beckman Instruments, Inc., Scientific & Process Instruments Div., 2500 Fullerton Rd., Fullerton, Calif.
Beech Aircraft Corp., 6600 East Central St., Wichita, Kan.
Bell Helicopter Corp., P.O. Box 482 Fort Worth 1, Tex.
Belle City Malleable Iron Co., Racine Steel Castings Co., 1442 Forest St., Racine, Wis.
Belmont Packing & Rubber Co., Butler & Sepviva Sts., Philadelphia 37, Pa.
Belmont Smelting & Refining Works, Inc., 330 Belmont Ave., Brooklyn 7, N. Y.
BEMIS BRO. BAG CO., 408 E. Pine St., St. Louis 2, Mo. P364
Benton Harbor Engineering Works, Inc., 622 Langley, St. Joseph, Mich.
Berger & Sons, C. L., Inc., 37 Williams St., Roxbury 19, Mass.
Beryllium Corp., Tuckerton Rd., Reading, Pa.
Bete Fog Nozzle, Inc., 309 Wells St., Greenfield, Mass.
Bethlehem Foundry & Machine Co., W. 2nd St., Bethlehem, Pa.
Bethlehem Pacific Coast Steel Corp., 20th & Illinois Sts., San Francisco, Calif.
BETHLEHEM STEEL CO., Bethlehem, Pa.
Bico, Inc., 3116 Valhalla Dr., Burbank, Calif. **PP68, 333**
B-I-F Industries, Inc., 345 Harris Ave., Providence 1, R. I.
Bigelow-Liptak Corp., 13300 Puritan Ave., Detroit 27, Mich.
Bin-Dicator Co., 13946 Kercheval St., Detroit 15, Mich.
Binks Mfg. Co., 3114 Carroll Ave., Chicago 12, Ill.
Bird Machine Co., South Walpole, Mass.
BIRDSBORO STEEL FOUNDRY & MACHINE CO., Birdsboro, Pa. P184
Birdwell, Inc., Bradford, Pa.
Bitco, Inc., P.O. Box 129, Nelson, B. C.
Bitco, Inc., P. O. Box 929, Wallace, Idaho.
Bitco, Inc., P. O. Box 255, Cardin, Okla.
Bitco, Inc., Main Office, E. 4115 Trent Ave., Spokane, Wash.
Bixby-Zimmer Engr. Co., 961 Abingdon St., Galesburg, Ill.
Black & Decker Mfg. Co., 600 East Pennsylvania Ave., Towson, Md.
Black Diamond Spad Co., 2108 Stratford Rd., Richmond 25, Va.
Black, Sivalls & Bryson, Inc., 7500 East 12th St., Kansas City 26, Mo.
Blackhawk Mfg. Co., 5325 West Rogers, Milwaukee 46, Wis.
Black's Machine Shop, 169 East Willow St., Bishop, Calif.
BLAW-KNOX CO., Blaw-Knox Bldg., 300 Sixth Ave., Pittsburgh 22, Pa. Sixth Ave., Pittsburgh 22, Pa. PP375-390
Blount Co., J. G. Woodland St., Everett 49, Mass.
Blue M Electric Co., 138 & Chatham St., Blue Island, Ill.
Blu-Ray, 301 Main Street, Ivoryton, Conn.
Bodinson Manufacturing Co., Inc., 2401 Bayshore Blvd., San Francisco, Calif.
Bolton Farm Packing Co., Inc., 176 Oak St., Newton 64, Mass.
Bonded Scale & Machine Co., 38 Bellevue, Columbus 7, Ohio.
Booth Co., 333 West 14 South St., Salt Lake City 4, Utah.
Borden Metal Products Co., Elizabeth, N. J.
Borne Chemical Co., Inc., 632 S. Front St., Elizabeth, N. J.
BOSTON WOVEN HOSE & RUBBER CO., Boston 3, Mass. P182
Bower Roller Bearing Div., Federal-Mogul-Bower Bearings, Inc., 5040 Hart Ave., Detroit 14, Mich.
Bowers Battery & Spark Plug Co., Box 1262, Reading, Pa.
BOYLES BROS. DRILLING CO., (Utah) 1321 South Main St., Salt Lake City, Utah.
BOYLES BROS. DRILLING CO., LTD., 1275-1291 Parker St., (Vancouver) Vancouver 6, Canada P363
Brabender Corp., Rochelle Park, N. J.
Brad Foote Gear Works, Pittsburgh Gear Co., Div. Neville Island, Pittsburgh 25, Pa.
Bradley Pulverizer Co., 123 So. 3rd St., Allentown, Pa.
Brady Co., W. H. 727 Glendale Ave., Milwaukee 9, Wis.
Brammer Corp., 684 Broadway New York 12, N. Y.
Branford Co., 132 Glen St., New Britain, Conn.
Brass Foundry Co., 713 S. Adams St., Peoria 2, Ill.
Briggs & Stratton Corp., 2711 North Thirteenth St., Milwaukee 1, Wis.
Bright Star Industries, 600 Getty Ave., Clifton, N. J.
Bristol Co., P. O. Box 1790 EMJ. Waterbury 20, Conn.
BRODERICK & BASCOM ROPE CO., 4203 Union Blvd., St. Louis 15, Mo. P191
Brooks Oil Co., 3304 East 87th St., Cleveland 27, Ohio.
Brooks Oil Co., 928 Ridge Ave., Pittsburgh 12, Pa.
Brookville Locomotive Works, Steele Blvd., Brookville, Pa.
Brosites Products Corp., 50 Church St., New York, N. Y.
Brown, Inc., David, 999 Beecher St., San Leandro, Calif.
Browning Mfg. Co., Maysville, Ky.
Bruning Co., Inc., Charles, 4702 Montrose Ave., Chicago 41, Ill.
BRUNNER & LAY INC., 2516 E. Cumberland St., Philadelphia 25, Pa. P371
Brunson Instrument Co., 1405 Walnut St., Kansas City 6, Mo.
BUCYRUS-ERIE CO., South Milwaukee, Wis. PP82, 128, 408
Budd Insulated Products, Inc., 81 Boston Post Road, Larchmont, N. Y.
BUELL ENGINEERING CO., 70 Pine St., New York 5, N. Y. P316
Buffalo Forge Co., 490 Broadway, Buffalo 5, N. Y.
Buffalo Hammer Mill Corp., 1238 McKinley Pkwy., P. O. Box 3, Buffalo 18, N. Y.
Buffalo Scale Co., Inc., 46 Letchworth St., Buffalo 13, N. Y.
Buffalo Wire Works Co., 308 Terrace St., Buffalo 2, N. Y.
Bullard Co., E. D., 2680 Bridgeway, Sausalito, Calif.
BullDog Electric Products Co., Detroit 32, Mich.
Bunker Hill Co., 660 Market St., San Francisco 4, Cal.
Bunting Brass & Bronze Co., 715 Spencer St., Toledo 1, Ohio.
Burgess Battery Co., Div. of Servel, Inc., Freeport, Ill.
Burndy Corp., Post Rd., Norwalk, Conn.
Burton Equipment Co., Inc., 4810 Firestone Blvd., South Gate, Calif.
Burtonite Co., Nutley 10, N. J.
Bush Engineering & Mfg. Co., No. 5 Lester Court, Salt Lake City 1, Utah.
Butler Bin Co., 993 Blackstone Ave., Waukesha, Wis.
Butler Manufacturing Co., 7400 East 13th St., Kansas City, Mo.
Byers Co., A. M., Clark Bldg., Pittsburgh 22, Pa.
Byron Jackson Pumps, Inc., Subsidiary Borg-Warner Corp., P. O. Box 2017, Terminal Annex, Los Angeles 54, Calif.

C

C—A Wood Preserver Co., 3622 Dover Pl., St. Louis 16, Mo.
C & D Batteries, Inc., Conshohocken, Pa.
C & D Div., Yuba Consolidated Industries, Inc., 701 East "Hy" St., Benicia, Calif.
Cabot, Inc., Samuel, 141 Milk St., Boston 9, Mass.
Cadillac Malleable Iron Co., Cadillac, Mich.
Cadman Mfg. Co., A. W., 2186 Smallman St., Pittsburgh 22, Pa.
Cahn Instrument Corp., 14511 Paramount Blvd., Paramount, California.
Calabrian Co., Inc., 141 Broadway, New York, N. Y.
Cal-Brea, Box 254, Brea, Calif.
Calcu-Tax Corp., 49 West 37 Street, New York, New York.
Caldwell Co., W. E., 2040 Brooks St., Louisville 8, Ky.
California Testing Laboratories, Inc., 619 E. Washington Blvd., Los Angeles 15, Calif.
Calumet Div., Calumet & Heckla, Inc., Calumet, MIch.
Cambridge Wire Cloth Co., 152 Linkwood Rd., Cambridge, Md.
Canadian Aero Service Ltd., 348 Queen St., Ottawa, Ontario, Canada.
Canadian Industries Ltd., P. O. Box 10, Montreal, Canada.
Canadian Locomotive Co., Ltd., Kingston, Ontario, Canada.
Cannon Concentrator Co., 1143 Sycamore St., P. O. Box 2432, Lakeland, Florida.
Carboline Co., 32 Hanley Ind. Ct., St. Louis 17, Mo.
Carbolineum Wood Preserving Co., 6683 N. 40th St., Milwaukee 9, Wis.
Carbon Engineering Corp., P. O. Box 256, Slinger, Wis.
Carbone Corp., 400 Myrtle Ave., Boonton, N. J.
CARD IRON WORKS, C. S. 2501 West 16th Ave., Denver 4, Colo. P348
Carey Mfg. Co., Philip, Lockland, Cincinnati 15, Ohio.
Cargille Laboratories, Inc., R. P., 117 Liberty St., New York 6, N. Y.
Carlon Products Corp., P. O. Box 133, Aurora, Ohio.
Carlyle Rubber Co., 103-107 Warren St., New York, N. Y.
Carpco Manufacturing, Inc., 4120 Haines St., Jacksonville, Fla.
Carpenter Steel Co., 115 W. Bern St., Reading, Pa.
Carrier Conveyor Corp., 211 North Jackson, Louisville 2, Ky.
Carrier Corp., Carrier Parkway, Syracuse 1, N. Y.
Carver Pump Co., Muscatine, Iowa.
CASE CO., J. I., INDUSTRIAL DIV., 700 State St., Racine, Wis. P392
Cash Co., A. W., P. O. Box 551, Decatur, Ill.
Catalytic Construction Co., 1528 Walnut St., Philadelphia 2, Pa.
CATERPILLAR TRACTOR CO., Peoria, Ill. PP5, 349, 357, 414
Cement Gun Co., 1520 Walnut St., Allentown, Pa.
Central Geophysics, Ltd., 325 Pembina Highway, Winnipeg, Manitoba.
Central Mine Equipment Co., 6200 North Broadway, St. Louis 15, Mo.
Central Scientific Co., 1700 Irving Park Road, Chicago 13, Ill.
Centric Clutch Co., P. O. Box 175, Woodbridge, N. J.
Centrifugal & Mech. Industries, Inc., 146 President St., St. Louis 18, Mo.
Century Electric Co., 1806 Pine St., St. Louis 3, Mo.
Cessna Aircraft Co., 5800 Franklin Rd., Wichita, Kan.
Chain Belt Co., 4679 West Greenfield Ave., Milwaukee 1, Wis.
Chain Belt Co., Shafer Bearing Div., 801 Burlington, Downers Grove, Ill.
Chapman, Wood & Griswold, 536 Jefferson St., N. E., P. O. Box 8302, Albuquerque, N. M.
Charlton Laboratories, 2340 S. W. Jefferson St., Portland 7, Ore.
Chart-Pak, Inc., 100 Lincoln Ave., Stamford, Conn.
Chase Bag Co., 155 East 44th St., New York 17, N.Y.
Chase Brass & Copper Co., 236 Grand St., Waterbury 91, Conn.
Chattillon & Sons, John, 85 Cliff St., New York 38, N. Y.
Chattanooga Boiler & Tank Co., 1036 E. Main St., Chattanooga 1, Tenn.
CHEATHAM ELECTRIC SWITCHING DEVICE CO., 4780 Crittenden Drive, Louisville 9, Ky. P439
Chelsea Fan & Blower Co., 639 South Ave., Plainfield, N. J.
Chemalco Inc., 2265 E. Foothill Blvd., Pasadena, Calif.
Chemical Construction Corp., 525 West 43rd St., New York, N. Y.
Chemical & Power Products, Inc., 11 Broadway, New York 4, N. Y.
Chemical Process Co., P. O. Box 829, Redwood City, Calif.
Chemical Separations Corp., P. O. Box 149, Oak Ridge, Penn.
Chesapeake & Ohio Railway, World Commerce Dept., Newport News, Va.
Chester Cable Corp., Subsidiary Miami Copper Co. 521 Fifth Ave., Chester, N. Y.
Chester Hoist Div., National Screw Mfg. Co., Lisbon, Ohio.
CHEVROLET MOTORS DIV., GENERAL Motors Corp., Detroit 2, Mich. P78
Chicago Belting Div., Chicago-Allis Mfg. Corp., 113 N. Green St., Chicago 7, Ill.
Chicago Bridge & Iron Co., 332 S. Michigan Ave., Chicago 4, Ill.
Chicago Expansion Bolt Co., 1338 W. Concord Pl., Chicago 22, Ill.
Chicago Eye Shield Co., 2727 W. Roscoe St., Chicago 18, Ill.
Chicago Perforating Co., 2445 W. 24th Pl., Chicago 8, Ill.
CHICAGO PNEUMATIC TOOL CO., East 44th St., New York 17, N. Y. PP188-189
Chicago Wheel & Mfg. Co., 1101 W. Monroe St., Chicago 7, Ill.
Chiksan Co., 330 North Pomona Ave., Brea, Calif.
Chisholm-Moore Hoist Div., Columbus McKinnon Chain Corp., 5045 Fremont Ave., Tonawanda, N. Y.
CHRISTENSEN DIAMOND PRODUCTS CO., 1937 South 2nd West St., Salt Lake City 10, Utah. PP60-61
Christian Engineers, J. D., 480 Potrero Ave., San Francisco 10, Calif.
Chrysler Corp., Dodge Truck Div., 7900 Joseph Campau Ave., Detroit, Mich.
Cincinnati Electrical Tool Co., 304 Mt. Hope Ave., Cincinnati 4, Ohio.
Cincinnati Mine Mach'y Co., 2980 Spring Grove Ave., Cincinnati 25, Ohio
Cincinnati Rubber Mfg., Co., Div., Thor Power Tool Co., Cincinnati 12, Ohio.
Circle F Mfg. Co., 720 Monmouth St., Trenton 4, N. J.
Circle Wire & Cable Corp., 5500 Maspeth Ave., Maspeth, N.Y.
Cities Service Oil Co., 54 Wall St., New York 5, N.Y.
Clarage Fan Co., 619 Porter St., Kalamazoo 16, Mich.
Clark Controller Co., 1146 E. 152nd St., Cleveland 10, Ohio.
CLARK EQUIPMENT CO., TRANSMISSION DIV., JACKSON 1, MICH. P405
CLARK EQUIPMENT CO., Construction Machinery Div., Box 599 Pipestone Rd. Benton Harbor, Mich.
Clarkson Co., 737 Loma Verde Ave., Palo Alto, Calif.
Clayton Manufacturing Co., P.O. Box 550 El Monte, Calif.
Cleveland Crane & Engrg. Co., 5866 E. 289 St., Wickliffe, Ohio.
Cleveland Electric Motor Co., 5213 Chester Ave., Cleveland 13, Ohio
CLEVELAND VIBRATOR CO., 2824 Clinton Ave., Cleveland 13, Ohio.
Cleveland Worm & Gear Co., 3300 East 80th St., Cleveland 4, Ohio.
Climax Molybdenum Co., 500 Fifth Ave., New York, N.Y.
Cline Truck Co., 3501 Gardner Ave., Kansas City 20, Mo.
Cling-Surface Co., 1032 Niagara St., Buffalo 13, N. Y.
Clipper Belt Lacer Co., 974 Front St., N.W. Grand Rapids 2, Mich.
Clipper Mfg. Co., 2800 Warwick St., Kansas City 8, Mo.
Clyde Iron Works, Inc., 29th Ave., West & Michigan St., Duluth, Minn.
Coal State Construction Co., Morgantown, W. Va.
Coast Mfg. & Supply Co., Box 71 Livermore, Calif.
Coast Metals, Inc., Redneck Ave., Little Ferry, N.J.
COATES STEEL PRODUCTS CO., Greenville, Ill. P147
Cochrane Corp., 17th & Allegheny,—3199 N. 17th St., Philadelphia, Pa.
Coeur d'Alene Hardware & Foundry Co., Wallace, Idaho.
Coffing Hoist Div. Duff-Norton Co., 800 Walter St., Danville, Ill.
Collier Carbon & Chemical Corp., 714 W. Olympic Blvd., Los Angeles 15, Calif.
Collins Co., 100 Front St., Collinsville, Conn.
Collyer Insulated Wire Co., 249 Roosevelt Ave., Pawtucket, R.I.
COLORADO FUEL & IRON CORP., Continental Oil Bldg., Denver 2, Colo. P440
Columbia Electric Mfg. Co., 4519 Hamilton Ave., N.E. Cleveland 14, Ohio.
Columbian Steel Tank Co., 1509 West 12th St., Kansas City 1, Mo.
Columbus Conveyor Co., 869 W. Goodale Blvd., Columbus 8, Ohio.
Columbus Forge & Iron Co., 544 W. First Ave., Columbus 8, Ohio.
Combustion Engineering Inc., 200 Madison Ave., New York 16, N.Y.
Combustion Engineering, Inc., Raymond Div., 1136 W. Blackhawk St., Chicago 22, Ill.
Commercial Shearing & Stamping Co., Dept. EMJ-MG, 1775 Logan Ave., Youngstown, Ohio.
Commercial Solvent Corp., 260 Madison Ave., New York 16, N.Y.
Commercial Testing & Engrg. Co., 228 North LaSalle St., Room 924 Chicago 1, Ill.
Compton, Inc., P.O. Box 1946, Clarksburg, W. Va.
Conco Engineering Works, Mendota, Ill.
Concordia Electric Co., 1521 Saw Mill Run Blvd., Pittsburgh 10, Pa.
Condenser Service & Engineering Co., 150 Observer Highway, Hoboken, N.J.
Cone-Drive Gears Div. Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Conley Frog & Switch Co., Bodley Ave., P.O. Box 3188, Memphis 9, Tenn.
CONNELLSVILLE MFG. & MINE SUPPLY CO., Connelsville, Pa. P317
Conrader Co., Inc., R. 236 W. 17th St., Erie, Pa.
Consolidated Electrodynamics Corp., 300 N. Sierra Madre Villa, Pasadena, Calif.
Consolidated Packaging Machinery Corp., 1400 West Ave., Buffalo 13, N.Y.
Construction Machy. Co., Box 120, Waterloo, Iowa.
Continental Copper & Steel Ind. Inc., Wooldridge Div. Sunnydale, Calif.

Continental-Diamond Fibre Corp., A Subsidiary of Budd Co., Newark, Del.
Continental Electric Co., Inc. 325 Ferry St., Newark 5, N.J.
CONTINENTAL GIN CO., Industrial Div. P.O. Box 2614, Birmingham 2, Ala.
Continental Mineral Processing Co., First National Bank Bldg., Cincinnati 2, Ohio.
Continental Motors Co., Muskegon, Mich.
Continental Ore Corp., 500 5th Ave., New York 36, N.Y.
Continental Rubber Works, 1939 Liberty St., Erie, Pa.
Control Corp., 718 Central Ave., Minneapolis 14, Minn.
Convair, Box 9671, Pittsburgh 26, Pa.
Conveyor Systems, Inc., 6451 Main St., Morton Grove, Ill.
Cooper-Bessemer Corp., Mt. Vernon, Ohio.
Coors Porcelain Co., 600 Ninth St., Golden, Colo.
Coover Railroad Track Brace Co., P. O. Box 254, Dayton 1, Ohio.
Copperweld Steel Co., 9th St., & Allegheny Ave., Glassport, Pa.
COPPUS ENGINEERING CO., 344 Park Ave., Worcester 10, Mass. P195
Corhart Refractories Co., 16th & Lee Sts., Louisville 10, Ky.
Cormac Photocopy Corp., 80 Fifth Ave., New York 11, N. Y.
Corning Glass Works, Corning, N. Y.
Coulter Industrial Sales Co., P. O. Box 22, Elmhurst, Illinois.
CRANE CO., 836 South Michigan Ave., Chicago 5, Ill. P168
Crane Puller Co., Waltham 54, Mass.
Crescent Belt Fastener Co., Inc., 381 Fourth Ave., New York, N. Y.
Crescent Insulated Wire & Cable Co., Olden & Taylor Aves., Trenton 5, N. J
Crosby Valve & Gage Co., 43 Kendrick St., Wrentham, Mass.
Crouse Hinds Co., Wolf & Seventh North Sts., Syracuse 1, N. Y.
CRUCIBLE STEEL CO. OF AMERICA, Oliver Bldg., Mellon Square, Pittsburgh 22, Pa. P155
Cullman Wheel Co., 1344 W. Altgeld St., Chicago 14, Ill.
Cummins Engine Co., Inc., 1000 Fifth St., Columbus, Ind.
Cummins Engine Co., Inc., Fifth & Union Sts., Columbus, Ind.
Curtis Manufacturing Co., 1905 Kienlen Ave., St. Louis 20, Mo.
CURTISS-WRIGHT CORP., Electronics DIV., 631 Central Ave., Carlstadt, N. J. P173
Custom Assay Office, Box 811, El Paso, Tex.
Cutler-Hammer, Inc., 237 N. 12th St., Milwaukee 1, Wis.

D

Dagley Mfg. Co., 1217 East Sixth St., Joplin, Mo.
Daniels Co., Contractors, Inc., 26 North Fifth St., Indiana, Pa.
Daniels, Inc., C. R., Daniels, Md.
Darling Valve & Mfg. Co., Foot of Walnut St., Williamsport, Pa.
Darworth, Inc., Chemical Products Div., Simsbury, Conn.
Davey Compressor Co., Kent, Ohio.
Davidson Co., M. T., 7 Dey St., New York 7, N. Y.
Davis Foundry & Machine Works, Old Furnace Road, Rome, Ga.
Dean Hill Pump Co., 4000 E. 16th St., Indianpolis 7, Ind.
Deason & Nichols, 160 South West Temple St., Salt Lake City 1, Utah.
DEERE CO., JOHN, Moline, Ill. P73
Dei-Con Eastern Corp., 60 Beaver St., New York, N. Y.
Delta-Star Electric Div., H. K. Porter Co., Inc., 2437 Fulton St., Chicago 12, Ill.
DEISTER CONCENTRATOR CO., 903 Glasgow Ave., Ft. Wayne, Ind. P326
Deister Machine Co., 1933 East Wayne St., Fort Wayne 4, Ind.
DeLaval Steam Turbine Co., 885 Nottingham Way, Trenton 2, N. J.
DeLong Engineering Corp., 29 Broadway, New York 6, N. Y.
Deltron Electric Products, Inc., Ebensburg, Pa.
Deming Co., 45 Broadway, Salem, Ohio.
Demo-Haines Tool Corp., Darco Industries, 2151 E. Rosecrans Ave., El Segundo, Calif.
Denver Equipment Co., P. O. Box 5268, Denver 17, Colo.
Denver Fire Clay Co., 2301 Blake St., P. O. Box 5510, Denver, Colo.
DeSousa Co., Inc., J. E., 217 Broadway, New York 7, N. Y.
Detectron Corp., 5528 Vineland Ave., North Hollywood, Calif.
DETROIT DIESEL ENGINE DIV., GENERAL MOTORS CORP., 13400 W. Outer Dr., Detroit 28, Mich. PP36-37
Detroit Hoist & Machine Co., 8224 Morrow St., Detroit 11, Mich.
Dewey & Almy Chemical Div., W. R. Grace & Co., 62 Whittemore Ave., Cambridge, Mass.
DeZURIK CORP., Sartell, Minn. P194
Diamond Chain Co., Inc., 452 Kentucky Ave., Indianapolis 7, Ind.
Diamond Drill Carbon Co., 244 Madison Ave., New York 16, N. Y.
DIAMOND DRILL CONTRACTING CO., Station B-Box 4065, South 18 Stone St., Spokane 15, Wash. P402
Diamond Iron Works Div. Goodman Mfg. Co., Halsted St., 48th Pl. Chicago 9, Ill.
Diamond Power Specialty Corp., Electronics Div., Lancaster, Ohio.
Diamond Products, Inc., 336 Prospect Ave., Elyria, Ohio.
DIAMOND TOOL RESEARCH CO., INC., 380 Second Ave., New York 10, N. Y. P406
Dick Co., R. & J., Totowa, N. J.
Dicke Tool Co., 1201 Warren Ave., Downers Grove, Ill.
Dickinson Laboratories, Inc., 1300 W. Main St., El Paso, Tex.
Diehl Mfg. Co., 1199 Finderne Ave., Somerville, N. J.
Dietz Co., Inc., Henry G., 12-16 Astoria Blvd., Long Island City 2, N. Y.
DIFFERENTIAL STEEL CAR CO., Findlay, Ohio P388
DIESEL ENERGY CORP., 82 Beaver St., New York, N. Y. P415
Dill Mfg. Co., 700 East 82nd Street, Cleveland 3, Ohio.
Dings Magnetic Separator Co., 4740 West Electric Ave., Milwaukee 46, Wis.
Dixon Crucible Co., Joseph, Monmouth & Wayne St., ersey City 3, N. .
Dixon Valve & Coupling Co., 2nd St. & Columbia Ave., Philadelphia 22, Pa.
DODGE MFG. CORP., South Union St., Mishawaka, Ind. P174
Dominion Steel & Coal Corp., Ltd. Canada Cement Bldg., Montreal, Quebec, Canada.
DORR-OLIVER, INC., Barry Place, Stamford, Conn. PP8-9
DOW CHEMICAL CO., T.S.O.B. Midland, Mich. P70-71
Dow Corning Corp., Midland, Mich.
Dravo Corp., Neville Island, Pittsburgh 25, Pa.
Dresser-Ideco Co., 975 Michigan Ave., Columbus 8, Ohio.
Dresser Mfg. Div. Dresser Industries, Inc., Bradford, Pa.
Drilling Accessory & Mfg. Co., Inc., 2006 S. Industrial, P. O. Box 5768, Dallas, Texas.
Drott Mfg. Co., 3841 West Wisconsin Ave., Milwaukee 8, Wis.
DUCON CO., INC., 153 East Second St., Mineola, N. Y. P178
Duff Norton Co., 2709 Preble Ave., Pittsburgh 30, Pa.
DuPont de Nemours & Co., Inc., E. I. Wilmington, Del.
DuPont de Nemours & Co., Inc., E. I. Explosives Dept., 2539 Nemours Bldg., Wilmington 98, Del.
DuPont de Nemours & Co., Inc., E. I. Fabrics Div. Fairfield 6, Conn.
Duquesne Mine Supply Co., Pittsburgh 9, Pa.
Durakool, Inc., 1010 N. Main St., Elkhart, Ind.
Duriron Co., Inc., 450 North Findlay St., Dayton 4, Ohio.
Dustex Corp., Box 2520, 1758 Walden Ave., Buffalo 25, N. Y.
Dwight-Lloyd Div., McDowell Co., Inc., 16300 Waterloo Rd., Cleveland 10, Ohio.

E

Eagle Iron Works, 262, Holcomb Ave., Des Mines 4, Iowa.
Eagle-Picher Co., American Bldg., Cincinnati 1, Ohio.
Eastman Kodak Co., Business Photo Methods Div., 343 State Street, Rochester 4, N. Y.
Eastman Mfg. Co., 1440 N. 24th St., Manitowoc, Wis.
Eastman-Pacific Co., 2320 East Eight St., Los Angeles 21, Calif.
Easton Car & Construction Co., Easton, Pa.
Eaton Mfg. Co., 739 E. 140th St., Cleveland 10, Ohio.
Edison, Industries, T. A., Edison Storage Battery Div., West Orange, N. J.
Edmund Scientific Co., 101 East Gloucester Pike, Barrington, New Jersey.
Edward Valves, Inc., 1200 W. 145th St., East Chicago, Ind.
EIMCO CORP., 634 South Fourth West St., Box 300, Salt Lake City 10, Utah. PP361,413
Eisler Engineering Co., 740 S. 13th St., Newark 3, N. J.
Elastic Stop Nut Corp., of America, 2330 Vauxhall Rd., Union, N. J.
Electric Controller & Mfg., Co., Div. Square D Co., 4500 Lee Rd., Cleveland 28, Ohio.
Electric Machinery Mfg. Co., 800 Central Ave., Minneapolis 13, Minn.
Electric Materials Co., North East, Pa.
Electric Steel Foundry Co., 2141 North West 25th Ave., Portland 10, Ore.
ELECTRIC STORAGE BATTERY CO., EXIDE INDUSTRIAL DIV., Rising Sun & Adams Ave., Philadelphia 20, Pa. P356
Electrical Fittings Corp., 37-50 57 St., Woodside 77, N. Y.
Electro Dynamics Div., General Dynamics Corp., Bayonne, N. J.
ELEKTROKEMISK A. S., 101 Park Ave., New York, N. Y. P422
Electro Lift, Inc., 204 Sargeant Ave., Clifton, N. J.
Electro Products Laboratories, 4501 North Ravenswood Ave., Chicago, Ill.
Electro Refractories & Abrasives Corp., Willets Rd., Buffalo 19, N. Y.
Elgin National Watch Co., Electronics Div., 2435 N. Naomi St., Burbank, Calif.
Elkhart Brass Mfg. Co., Inc., 1302 W. Beardsley Ave., Ekhart, Ind.
Elliott Co., 900 North Fourth Ave., Jeannette, Pa.
ELLICOT MACHINE CORP., 1657 Bush St., Baltimore 30, Md. P192
Elliott Service Co., Inc., 30 North MacQuesten Pkwy., Mt. Vernon, N. Y.
El Paso Testing Laboratories, El Paso, Tex.
Elreco Corp., 2900 Cormany Ave., Cincinnati 25, Ohio.
El-Tronics, Inc., 1360 Sub. Sta. Build. Philadelphia 3, Pa.
Emery Industries, Inc., Crew Tower Cincinnati 2, Ohio.
Empire Steel Castings, Inc., Box 139, Reading, Pa.
Endicott Forging & Mfg. Co., 1901 North St., Endicott, N. Y.
Engelhard, Inc., Charles, 850 Passaic Ave., East Newark, N. J.
Engelhard Industries, Inc., 113 Astor St., Newark, N. J.
Engineered Equipment, Inc., 1001 Linden Ave., Waterloo, Iowa.
Engineers Syndicate, Ltd., 5011 Hollywood Blvd., Hollywood, Calif.
Engler Instrument Co., 250 Culver Ave., Jersey City 5, N. J.
Enley Products, Inc., 1236 Broadway, Brooklyn 21, N. Y.
ENSIGN-BICKFORD CO., Simsbury, Conn. P59
Ensign Electric & Mfg. Co., 914 Adams Ave., Huntington 4, W. Va.
Enterprise Wheel & Car Corp., Bristol, Va.
EQUIPMENT ENGINEERS INC., 737 Loma Verde Ave., Palo Alto, Calif. P399
Equitable Paper Bag Co., Inc., 45-50 Van Dam St., Long Island City 1, N. Y.
Equitable Powder Mfg. Co., East Alton, Ill.
Erie Pump & Engine Works, 144 Glenwood Ave., Medina, N. Y.
Erie Strayer Co., Erie, Pa.
Eriez Mfg. Co., 263 Magnet Dr., Erie, Pa.
Essex Wire Corp., Paranite Wire & Cable Div., 1601 Wall St., Fort Wayne 6, Ind.
Essick Manufacturing Co., 1950 Santa Fe Ave., Los Angeles 21, Calif.
Esso Standard Oil Co., National & Comm. Sales Div., 15 West 51st St., New York 19, N. Y.
Esteline-Angus Co., Inc., P. O. Box 596, Indianapolis 6, Ind.
Ettco Wire & Cable Corp., 75 Onderdonk Ave., Brooklyn 37, N. Y.
EUCLID DIV., GENERAL MOTORS CORP., 1361 Chardon Rd., Cleveland 17, Ohio. P86
Eutectic Welding Alloys Corp., 40-40 172nd St., Flushing 58, N. Y.
Evanite Plastic Co., Div. Evans Pipe Co., 23 Newport Ave., Uhrichsville, Ohio.
Everlasting Valve Co., 49 Fisk St., Jersey City 5, N. J.
EXOLON CO., East Niagara St., Tonawanda, N. Y. P418
Exploration Methods Inc., P. O. Box 100, Ishpeming, Mich.
Extremultus, Inc., 405 Lexington Ave., New York, N. Y.

F

F. A. B. Mfg. Co., 1249—67th St., Oakland 8, Calif.
Fafnir Bearing Co., 37 Booth St., New Britain, Conn.
Fahrenwald Co., A. W. E., 3500 Riverside, Spokane, Wash.
Failing Co., George E., Enid, Okla.
Fairbanks Co., 393 Lafayette St., New York 3, N. Y.
FAIRBANKS, MORSE & CO., 600 South Michigan Ave., Chicago 5, Ill. P395
Fairchild Aerial Surveys, Inc., 224 E 11th St., Los Angeles, Calif.
Falcon Alarm Co., Inc., 243 Broad St., Summit, N. J.
FALK CORP., 3049 West Canal St., Milwaukee 1 ,Wis. P89
Farbwerke Hoechst, A. G., Frankfurt (M)—Hoechst, Germany
Farrel-Birmingham Co., Inc., Ansonia, Conn.
Farrell-Cheek Steel Co., Sandusky, Ohio.
FARRIS FLEXIBLE VALVE CORP., 463 Commercial Ave., Palisades, N. J. P330
Farval Corp., 3300 East 80th St., Cleveland, Ohio.
FATE-ROOT-HEATH CO., Bell, High & Pine St., Plymouth, Ohio, P142
Fawick Airflex Co., Inc., 9919 Clinton Ave., Cleveland 11, Ohio.
Federal Bearings Co., Inc., Poughkeepsie, N. Y.
Federal-Mogul Service Div., Federal-Mogul-Bower Bearings, Inc., 11031 Shoemaker, Detroit 13, Mich.
Federal Motor Truck Div., Napco Industries Inc., 7th St.—N. Lyndale, Minneapolis 11, Minn.
Federal Pacific Electric Co., Pacific Switchgear Div., 5815 Third St., San Francisco 24, Calif.
Federal Pacific Electric Co., 50 Paris St., Newark 5, N.J.
Federal Sign & Signal Corp., 8763 South State St., Chicago 19, Ill.
Federal Telephone & Radio Div., International Tel. & Tel. Corp., 100 Kingsland Rd., Clifton, N.J.
Felt Products Mfg. Co., 7450 N. McCormick Blvd., Skokie, Ill.
Femco, Inc., Irwin, Pa.
FIRESTONE TIRE & RUBBER CO., 12 South Main St., Akron 17, Ohio. P75
Firth Sterling Inc., 3113 Forbes Ave., Pittsburgh 30, Pa.
Fisher Research Laboratory, Inc., 1961 University Ave., Palo Alto, Calif.
Fischer & Porter Co., 415 Warminster Rd., Hatboro, Pa.
Fisher Scientific Co., 717 Forbes Ave. Pittsburgh 19, Pa.
FISKE BROS. REFINING CO., Lubriplate Div., 129 Lockwood St. Newark 5, N. J. P416
Fitz Simons & Connell Dredge & Dock Co., 10 South LaSalle St., Chicago 3, Ill.
Fletcher & Co., J. H., 707 W. 7th St., Huntington, W. Va.
Flexaust Co., 100 Park Ave., New York 17, N.Y.
FLEXIBLE STEEL LACING CO., 4607 Lexington St., Chicago 44, Ill. P418
Flexible Tubing Co., Guilford, Conn.
Flexo Products, Inc., 24864 Detroit Rd., Westlake, Ohio.
Flocker & Co., John, 644 Grant St., Pittsburgh 19, Pa.
Flood City Brass & Elec. Co., Johnstown, Pa.
Fluor Products Co., Hartmann Div., 1200 East Washington Blvd., Whittier, Calif.
Fly Ash Arrestor Corp., P.O. Box 1883 Birmingham 1, Ala.
Foley Bros. Construction Co., Pleasantville, N.Y.
Food Machinery & Chemical Corp., Packing Equipment Div., P.O. Box 552, Riverside, Calif.
Peerless Pump Div., Food Machinery & Chemical Corp., 301 West Ave., 26, Los Angeles 31, Calif.
Food Machinery & Chemical Corp., Westvaco Mineral Products Div., Westvaco Chlor-Alkali Div., 161 E. 42nd St., New York 17, N.Y.
Foote Bros. Gear & Machine Corp., 4545 S. Western Blvd., Chicago 9, Ill.
FORD MOTOR CO., P.O. Box 658, Dearborn, Mich. PP40-41
Forker Corp., 2044 Random Rd., Cleveland 6, Ohio.
Formica Corp., Subsidiary of Cyanamid 4614 Spring Grove Ave., Cincinnati 32, Ohio.

Foster Co., L. B. P.O. Box 1647 Pittsburgh 30, Pa.
Foster Wheeler Corp., 666 Fifth Ave., New York 19, N.Y.
Foxboro Co., Foxboro, Mass.
Frank, M. K., 480 Lexington Ave., New York 17, N.Y.
Franklin Plastics Inc., 315 Grant St., Franklin Pa.
Frantz Co., Inc. S. G., Brunswick Pike & Kline Ave., P.O. Box 1138, Trenton 6, N.J.
Frazier Davis Construction Co., 1319 Macklind Ave., St. Louis, Mo.
Frederick Pest Co., 3650 N. Avondale Ave., Chicago 18, Illinois.
Frog, Switch & Mfg. Co., Carlisle, Pa.
Frontier Mfg. Co, P.O. Box 13266, 10600 Harry Hines Blvd., Dallas, Texas.
Fruehauf Trailer Co., 10940 Harper Ave., Detroit 32, Mich.
Fuller Co., Catasauqua, Pa.
Fuller Manufacturing Co., 1410 North Burdick St., Kalamazoo, Mich.
Fuel Process Co., D at 10th St., South Charleston, W. Va.
Fulton Bag & Products Co., 1400 Annunciation St., New Orleans 13, La.
FWD Corp., Clintonville, Wis.
Fyr-Fyter Co., 221 Crane St., Dayton 1, Ohio.

G

Galigher Co., P.O. Box 209, Salt Lake City 10, Utah.
Galion Allsteel Body Co., Galion, Ohio.
Galion Iron Works, Galion, Ohio.
Galland Henning Mfg. Co., Nopak Div. 2753 S. 31st St., Milwaukee 46, Wis.
G. & W. Electric Specialty Co., 3500 W. 127th St., Blue Island, Ill.
Gar Wood Industries, Inc., Wayne, Mich.
GARDNER-DENVER CO., Quincy, Ill. PP30-31
Garlock Packing Co., 402 East Main St., Palmyra, N.Y.
Garrett Corp., 9851 Sepulveda Blvd., Los Angeles 45, Calif.
Gates Engrg. Co., 100 South West St., Wilmington 99, Del.
GATES RUBBER CO., 999 South Broadway, Denver 17, Colo. P157
Gatke Corp., 228 N. LaSalle St., Chicago 1, Ill.
GENERAL AMERICAN TRANSPORTATION CORP., 135 South LaSalle St., Chicago 90, Ill. P145
GENERAL AMERICAN TRANSPORTATION CORP., Louisville Dryer Div., 139 South Fourth St., Louisville, Ky.
General Cable Corp., 420 Lexington Ave., New York 17, N.Y.
GENERAL CHEMICAL DIV., ALLIED CHEMICAL CORP., 40 Rector St., N. Y. 6, N.Y. P192
GENERAL ELECTRIC CO., APPARATUS SALES DIV. Schenectady 5, N.Y.
GENERAL ELECTRIC CO., COMMUNICATION PRODUCTS DEPT., Lynchburg, Va.
GENERAL ELECTRIC CO. CONSTRUCTION MATERIALS DIV., 1285 Boston Ave., Bridgeport 2, Conn.
GENERAL ELECTRIC CO., FOUNDRY DEPT., Schenectady, N. Y.
GENERAL ELECTRIC CO., GEAR MOTOR & TRANSMISSION COMPONENTS DEPT., 845 E. 25th st., Paterson, N. J.
GENERAL ELECTRIC CO., IND. HAULAGE DIV.—LOCO. & CAR EQUIP. DIVS. 2901 East Lake Rd., Erie, Pa.
GENERAL ELECTRIC CO., WIRE & CABLE & CONDUIT PRODUCTS DEPTS., 1285 Boston Ave., Bridgeport 2, Conn.
General Equipment & Mfg. Co., 120 S. Campbell St., Louisville, Ky.
General Mills, Inc., Fourth St., & Second Ave., S. Minneapolis, Minn.
GENERAL MOTORS CORP., ALLISON DIV. 4700 West Tenth St., Indianapolis 6, Ind.
GENERAL MOTORS CORP., ELECTRO-MOTIVE DIV., La Grange, Ill.
GENERAL MOTORS CORP., DETROIT DIESEL ENGINE DIV., 13400 W. Outer Drive, Detroit 28, Mich. PP36-37
General Nuclear Corp., 550 Fifth Ave., New York 38, N. Y.
General Refractories Co., 1520 Locust St., Philadelphia, Pa.
General Splice Corp., 85 Spring St., South Norwalk, Conn.
General Steel Warehouse Co., Inc. Genscо Tool Div., 1830 North Kostner Ave., Chicago 39, Ill.
General Switch Co., Div. Norbute Corp., 45 Roebling St., Brooklyn 11, N.Y.
GENERAL TIRE & RUBBER CO., 1708 Englewood Ave., Akron, Ohio. P33
Geochemical Prospecting Laboratory, 460 Newton Street, Denver 4, Colorado.
GEODIMETER CO., 1170 Broadway, N.Y. 1, N.Y. P164
Geo-Optic & Paper Corp., 149 Church St., New York 7, N.Y.
Geophysical Instrument & Supply Co., 1616 Broadway, Denver 2, Colorado.
Geophysical Specialties Co., 4206 Longfellow St., Minneapolis, Minn.
Georgia Iron Works Co., 605 12th St., Augusta, Ga.
Geo-Resource Corp., 525 Hutton Bldg., Spokane, Wash.
Gerber Scientific Instrument Co., 162 State St., Hartford 1, Conn.
Gering Products, Inc., North Seventh St., Kenilworth, N. J.
Getman Brothers, U. S. 31, South Haven, Mich.
Giant Grip Mfg. Co., 29 Osceola St., Oshkosh, Wis.
Gibraltar Equipment & Mfg. Co., P.O. Box 304, Alton, Ill.
Gilson Screen Co., 110 Center St., Malinta, Ohio.
Gladding, McBean & Co., 2901 Los Feliz Blvd., Los Angeles 39, Calif.
GODOY & CO., INC., E. A., 25 Broadway, New York 4, N.Y. P402
Goldak Co., Inc. 1544 West Glenoaks Blvd., Glendale 1, Calif.
Golden-Anderson Valve Specialty Co., 1232 Ridge Ave., Pittsburgh 33, Pa.
Goodall Brothers, 46 S. Main St., Helena, Mont.
Goodman Mfg. Co., 48th Place & Halstead, Chicago, Ill.
GOODRICH AVIATION PRODUCTS, B.F. DIVISION, B. F. GOODRICH CO., Troy, Ohio.
GOODRICH CO., B. F. TRUCK & BUS TIRE DEPT., 500 South Main St., Akron 18, Ohio. P127
GOODRICH INDUSTRIAL PRODUCTS CO., B.F., 476 Main St., Akron 18, Ohio. P3
Goodall Rubber Co., Whitehead Rd., Trenton, N. J.
GOODYEAR TIRE & RUBBER CO., 1144 East Market St., Akron 16, Ohio.
GOODYEAR TIRE & RUBBER CO., INDUSTRIAL PRODUCTS, 1144 East Market St., Akron, Ohio. P11
Gorman Rupp Co., Mansfield, Ohio.
GOULD CO., GORDON I., 58 Sutter St., San Francisco 4, Calif., P418
GOULD-NATIONAL BATTERIES, INC., Trenton 7, N. J. P154
Goulds Pumps, Inc., Seneca Falls, N.Y.
Goyne Pump Co., Ashland, Pa.
Grace & Co., W. R. Hanover Square, New York, N. Y.
Gramm Trailer Corp., 425 E. O'Connor Ave., Lima, Ohio.
Graton & Knight Co., 356 Franklin St., Worcester 4, Mass.
Graver Tank & Mfg. Co., Div. Union Car Co., East Chicago, Ind.
Graver Water Conditioning Co., 216 W. 14 St., New York 11, N. Y.
Gray Co., Inc. 60-11th Ave., N.E. Minneapolis 13, Minn.
Gray Instrument Co., 200 E. Church Lane, Philadelphia 44, Pa.
Grabar Elec. Co., Inc. 420 Lexington Ave., New York 17, N. Y.
Green Fire Brick Co., A. P. Mexico, Mo.
Greene, Tweed & Co., North Wales, Pa.
Greensburg Machine Co., Greensburg, Pa.
Gregg Co., Ltd., 214 Main St., Hackensack, N. J.
GRINNELL CO., Inc., 260 West Exchange St., Providence 1, R. I. P90
Griphoist, Inc., 424 Bryant St., San Francisco 9, Calif.
Gruendler Crusher & Pulverizer Co., 2915 North Market St., St. Louis 6, Mo.
Gulf Oil Corp., Dept. DM Gulf Bldg., P.O. Box 1166, Pittsburgh 30, Pa.
Gundlach Machine Co., T. J. Div. of JMJ Industries, Inc., 226 Centreville Ave., Belleville, Ill.
Gurley, W. & L. E., 514 Fulton St., Troy, N. Y.
Gustin-Bacon Mfg. Co., 210 West Tenth St., Kansas City, Mo.
Guyan Machy. Co., 755 Stratton, Logan, W. Va.
Gwilliam Co., 360 Furman St., Brooklyn 1, N. Y.

H

H-B Instrument Co., Inc., American & Bristol Sts., Philadelphia 40, Pa.
H. & L. Tooth Co., 1540 South Greenwood Ave., Montebello, Calif.
Hack Engineering Co., 124 Wazee Market, Denver, Colo.
Hagan Chemicals & Controls, Inc., Divisions: Calgon Co., Hall Laboratories, Hagan Bldg., Pittsburgh 30, Pa.
Hales Co., W. M. Box 65, 700 Commerce St., Danville, Ill.
Hall & Sons, Amos H., 5500 N. Water St., Philadephia 20, Pa.
Hallett Diesel Engine Div. American MARC, Inc., 1601 W. Florence Ave., Inglewood, Calif.
Hamer Valves, Inc., P.O. Box 1851, Long Beach 1, Calif.
HAMILTON RUBBER MFG. CORP., Meade St., Trenton, N. J. P139
Hammermills, Inc. 625 C Ave., N.W., Cedar Rapids, Iowa.
Hammond Co, J. V. Spangler, Pa.
Handy & Harman, 82 Fulton St., New York 38, N. Y.
Hanks, Inc., Abbott A., 624 Sacramento St., San Francisco 11, Calif.
Hapman Conveyors, Inc., 630 Gibson St., Kalamazoo 6, Mich.
HARBISON-WALKER REFRACTORIES CO., 307 Fifth Ave., Pittsburgh 22, Pa. PP338-339
Hard-N-Tuff Corp., Box 275, Huntington, N. Y.
HARDINGE CO., INC., 240 Arch St. York, Pa. PP378-379
HARNISCHFEGER CORP., 4400 W. National Ave., Milwaukee 46, Wis.
HARNISCHFEGER CORP., P & H DIESEL DIV., Crystal Lake, Ill. PP64-65
Harper Electric Furnace Corp., 110 Pearl St., Buffalo 2, N. Y.
Harrington Co., Gravers Rd., at the Turnpike, Plymouth Meeting, Pa.
Hart Mfg. Co., 119 Bartholomew Ave., Hartford, Conn.
Hartman Div. Fluor Products Co., 1200 E. Washington Blvd., Whittier, Calif.
Hartzell Propeller Fan Co., P.O. Box 909, Piqua, Ohio.
Hauck Manufacturing Co., 126 Tenth St., Brooklyn 15, N. Y.
Hauser-Stander Tank Co., 4820 Spring Grove Ave., Cincinnati 32, Ohio.
Havlick, J. L., 112 S. Cedar St., Spokane, Wash.
Hawley & Hawley, Assayers & Chemists, Inc., Box 1060, Douglas, Ariz.
Hawthorne, Inc., Herb J., Box 7366 Houston 8, Tex.
Hayes Steel Products, LTD., Merritton, Ontario, Canada.
Haynes Stellite Co. Div. Union Carbide Corp., Kokomo, Ind.
Hayward Co., 50 Church St., New York, N. Y.
Hazemag USA, Inc., 122 E. 42 St., New York 17, N. Y.
Heil Co., Tec Div., 3000 W. Montana, Milwaukee, Wis.
Heineken, Inc., W. P., 50 Braod St., New York, N. Y.
Heinemann Electric Co., 98 Plum St., Trenton 2, N. J.
Heinrichs Exploration Co., G. O. P.O. Box 5671, Tucson, Ariz.
Heintz Mfg. Co., 13110 Enterprise Ave., Cleveland 11, Ohio.
Helmick Foundry-Machine Co., P.O. Box 71, Fairmount, W. Va.
Helwig Co., 2544 N. 30th St., Milwaukee 10, Wis.
HENDRICK MFG. CO., Carbondale, Pa. P132
Hendrickson Mfg. Co., 8001 W. 47th St., Lyons, Ill.
Hendrix Mfg. Co., Mansfield, La.
HERCULES MOTORS CO., 101-11 St., S. E. Canton, Ohio. P146
HERCULES POWDER CO., 933 King St., Wilmington, Del. P355
Hercules Steel Products Corp., Galion, Ohio.
Hertner Electric Co., 12690 Elmwood Ave., N. W. Cleveland 11, Ohio.
Hevi-Duty Electric Co., 2040 W. Wisconsin Ave., Milwaukee 1, Wis.
HEWITT-ROBINS, INC., 666 Glenbrook Rd., Stamford, Conn. P340
Heyden Newport Chemical Corp., 342 Madison Ave., New York, New York.
Heyl & Patterson, Inc., 55 Fort Pitt Blvd., Pittsburgh 22, Pa.
Hill & Jude, Assayers, 800 Pearl St., Boulder, Colo.
Hiller Helicopters, 1350 Willow Rd., Palo Alto, Calif.
Hills-McCanna Co., 4644 W. Touhy Ave., Chicago 30, Ill.
Hirsch Bros. Machy. Co., P.O. Box 226, El Paso, Tex.
Hisey-Wolf Machine Co., Galvin & Mt. Hope Aves., Cincinnati 4, Ohio.
H. K. PORTER COMPANY, INC., 2500 First National Bank Bldg., Pittsburgh, Pa.
H. K. PORTER COMPANY, INC., NATIONAL ELECTRIC DIV., Porter Building, Pittsburgh 19, Pa.
H. K. PORTER COMPANY, INC., THERMOID DIV., Tacony & Comly Sts., Philadelphia 24, Pa. P347
H. K. PORTER COMPANY, INC., REFRACTORIES DIV., 3 Penn Center, Phila. 2, Pa. P345
Hobart Bros. Co., Main & Adams St., Troy 1, Ohio.
Hockensmith Corp., Penn, Pa.
Hoffman Bros. Brilling Co., Tiona St., Ext. Punxsutawney, Pa.
Holman Bros.—Canada Ltd., 97 Kent Ave., Kitchener, Ontario, Canada.
Holmes & Bros., Inc. Robert, 570 Junction Ave., Danville, Ill.
Homer Mfg. Co., Lima, Ohio.
Homelite Div., Textron Inc., 75 Riverdale Ave., Port Chester, N. Y.
Hose-McCann Telephone Co., Inc., 25th St., & Third Ave., Brooklyn 32, N.Y.
Hossfeld Mfg. Co., Winona, Minn.
HOUGH CO., THE FRANK G., 726 Seventh St., Libertyville, Ill. PP-382-383
Houghton & Co., E. F., 303 W. Lehigh Ave., Philadelphia 33, Pa.
House & Sons, Inc., Chas. W., Unionville, Conn.
Houston Technical Laboratories, 2424 Brenard St., Houston 6, Texas.
Houston Tool Co., Inc. Santa Susana, Calif.
Howe Scale Co., Inc. Rutland, Vt.
Howell Electric Motors Co., Howell, Mich.
Hoyland Steel Co., Inc. 5104 Chrysler Bldg., 405 Lexington Ave., New York, N. Y.
Hoyt Wire Cloth Co., Box 1577, Lancaster, Pa.
HUBER-WARCO CO., Marion, Ohio P353
Hughes & Sons, Inc., Summersville, West Virginia.
Hughes Tool Co., 300 Hughes. Houston, Tex.
Hulburt Oil & Grease Co., Trenton & Castor Aves., Philadelphia 34, Pa.
Humphreys Investment Co., Engineering Div., 915 First National Bank Bldg., Denver 2, Colo.
Hunt & Son, Inc., C. B., Salem, Ohio.
Hunting Tech. & Exploration Serv. Ltd., 1450 O'Conner Dr., Toronto 16, Canada.
Hutchinson Bag Corp., Hutchinson, Kans.
Hyatt Bearings Div., General Motors Corp., 427 Middlesex St., Harrison, N. J.
Hycon Aerial Surveys, Inc., 1020 S. Arroyo Pkwy., Pasadena, Calif.
Hypro Engineering, Inc., 700 39 Ave., N. E. Minneapolis 21, Minn.
Hyster Co., 2965 N. E. Clackamas St., Box 4318, Portland 8, Ore.

I

I-T-E Circuit Breaker Co., 19th & Hamilton Sts., Philadelphia 30, Pa.
Ideal Electric & Mfg. Co., Mansfield, Ohio.
Ideal Industries, Inc., 1020 Park Ave., Sycamore, Ill.
Ilg Electric Ventilating Co., 2850 N. Pulaski Rd., Chicago 41, Ill.
Illinois Iron & Bolt Co., 1932 Thomas St., Carpentersville, Ill.
Illinois Powder Mfg. Co., 506 Olive St., St. Louis 1, Mo.
Illinois Testing Laboratories, Inc., 420 N. La Salle St., Chicago 10, Ill.
Imperial-Cantrell Mfg. Co., P.O. Box 538, Jellico, Tenn.
Imperial Electric Co., 63 Ira Ave., Akron 9, Ohio.
Imperial Oil & Grease, 6505 Wilshire Blvd., Los Angeles, Calif.
Indiana Foundry Co., Indiana, Pa.
Industrial Air Products Co., 3200 N. W. Yeon Ave., Portland 10, Ore.
Industrial Brownholst Corp., 135 Washington Ave., Bay City, Mich.
Industrial Engrg. & Construction Co., First National Bank Bldg., Fairmont, W. Va.
Industrial Gloves Co., 700 Garfield St., Danville, Ill.
Industrial Overlay Metals, Inc., 410 N. Barron St., Eaton, Ohio.
Industrial Nucleonics Corp., 1203 Chesapeake Ave., Columbus, Ohio.
INDUSTRIAL PHYSICS & ELECTRONICS CO., 470 South Tenth East St., Salt Lake City 2, Utah. P417
INFILCO, INC., 901 S. Campbell Ave., Tucson, Ariz. P404
INGERSOLL-RAND CO., 11 Broadway, New York 4, N.Y. P1
Inland Steel Co., 38 S. Dearborn St., Chicago 3, Ill.
Inland Steel Products Co., 4101 W. Burnham St., Milwaukee 1, Wis.
Insley Manufacturing Corp., 801 N. Olney St., Indianapolis 6, Ind.
International Electronics Corp., 1551 Franklin Ave., Mineola, New York.
INTERNATIONAL BARTERING CO., 52 Broadway, New York, N.Y. P419 .

INTERNATIONAL HARVESTER CO., DROTT DIV., Milwaukee 15, Wis.
INTERNATIONAL HARVESTER CO., INDUSTRIAL POWDER DIV., Chicago 1, Ill. PP134-138
INTERNATIONAL HARVESTER CO., MOTOR TRUCK DIV., 180 North Michigan Ave., Chicago 1, Ill.
INTERNATIONAL HARVESTER EXPORT CO., 180 No. Michigan Ave., Chicago 1, Ill.
INTERNATIONAL MINERALS & METALS CORP., 11 Broadway, New York 4, N.Y. P368
INTERNATIONAL NICKEL CO., 67 Wall St., New York 5, N.Y. P409
International Research & Development Corp., 797 Thomas Lane. Columbus 16, Ohio.
International Salt Co., Scranton 2, Pa.
International Shoe Co., 1509 Washington Ave., St. Louis 3, Mo.
Interstate Drop Forge Co., 4051 27th St., Milwaukee 16, Wis.
Interstate Equipment Corp., 433 N. Broad St., Elizabeth 3, N.J.
Ionics, Inc., 152 Sixth St., Cambridge 42, Mass.
IOWA MFG. CO., 916-16th St., N.E. Cedar Rapids, Iowa, P183
Ironton Engine Co., Farmingdale, N.J.
Ironton Fire Brick Co., Ironton, Ohio.
Irwin-Sensenich Corp., Box 311, Irwin, Pa.
Irvington Div. Minnesota Mining & Mfg. Co., 6 Argyle Terrace, Irvington 11, N.J.
Irving Subway Grating Co., Inc., 50-99 27th St., Long Island City 1, N.Y.
Isbell Construction Co., P.O. Box 2351, Reno, Nev.

J

Jacsco Pumps, 2031 N. Lincoln St., Burbank, Calif.
Jacuzzi Bros. Inc., Richmond, Calif.
Jaeger Machine Co., 550 W. Spring St., Columbus 16, Ohio.
Jarrell-Ash Co., 28 Farwell St., Newtonville 60, Mass.
Jefferson Union Co., 31 Fletcher Ave., Lexington, Mass.
JEFFREY MFG. CO., 974 N. Fourth St., Columbus 16, Ohio. P190
JENKINS BROS., 100 Park Ave., New York 17, N.Y. P121
Jesco Lubricants Co., P.O. Box 7331 Kansas City 16, Mo.
Jessop Steel Co., 538 Green St., Washington, Pa.
Jet-Lube Inc., 3093 North California St., Burbank, Calif.
Johns-Manville, 22 E. 40th St., New York 16, N.Y.
Johnson Belting Co., 44 Hubert St., New York 13, N.Y.
Johnson Bronze Co., 492 S. Mill St., New Castle, Pa.
Johnson Corp., 816 Wood St., Three Rivers, Mich.
Johnson Co., C. S., P. O. Box 71. Champaign, Ill.
Johnson Co., R. G., 25 S. College St., Washington, Pa.
Johnson Loading Supplies, G. R., 5026 Butterworth Rd., Mercer Island, Wash.
Johnson-March Corp., 3018 Market St., Philadelphia 4, Pa.
Johnson Plastic Corp., 201 Brown Rd., Chagrin Falls, Ohio.
Johnston-Morehouse-Dickey Co., 704 Second Ave., Pittsburgh 19, Pa.
Johnson Pump Co., 3272 E. Foothill Blvd., Pasadena 8, Calif.
JONES & LAUGHLIN STEEL CORP., 3 Gateway Center, Pittsburgh 30, Pa. PP314-315
JOY MFG. CO., Henry W. Oliver Bldg., Pittsburgh 22, Pa. PP197-200,404
Joyce-Cridland Co., 2027 E. First St., Dayton, Ohio.
Judsen Rubber Works, Inc., 4107 West Kinzie St., Chicago 24, Ill.
Junction Bit & Tool Co., 801 4th Ave., Grand Junction, Colo.
Justrite Mfg. Co., 2061 Southport Ave., Chicago 14, Ill.

K

Kaiser Aluminum & Chemical Sales, Inc., 1924 Broadway, Oakland 12, Calif.
KAISER ENGINEERS, 1924 Broadway, Oakland, Calif. P129
Kanawha Mfg. Co., 1520 Dixie St., Charleston 1, W. Va.
Kansas City Hay Press, 801 Woodswether Rd., Kansas City, Mo.
Kato Engineering Co., Mankato, Minn.
Kaydon Engineering Corp., Muskegon, Mich.
Keasbey & Mattison Co., Ambler, Pa.
Keeney Co., Paul E., 1125 S. E. Grand Ave., Portland 14, Ore.
Keeler Co., E., 238 West St., Williamsport 3, Pa.
KELLOGG CO., M. W., 711 Third Ave., New York 17, N. Y. P140
Kennametal Inc., Mining Tool Div., Bedford, Pa.
Kenco Pump Div., American Crucible Products Co., 1305 Oberlin Ave., Lorain, Ohio.
Kennedy Valve Mfg. Co., Elmira, N. Y.
KENNEDY-VAN SAUN MFG. & ENG. CORP., 2 Park Ave., New York, N.Y. P62
Kensington Steel, Div. Pneumo & Co., 505 Kensington Ave., Chicago 28, Ill.
Kenyon Walker Machinery Co., 1600 11th St., Denver 2, Colorado.
Kerite Co., 30 Church St., New York 7, N. Y.
Kern Instruments, Inc. 120 Grand St., P. O. Box 727 White Plains, N. Y.
Kersey Mfg. Co., Inc., P. O. Box 151, Bluefield, Va.
Keuffel & Esser Co., 300 Adams St., Hoboken, N. J.
Keystone Carbon Co., State St., St. Marys, Pa.
Keystone Lubricating Co., 21st & Clearfield Sts., Philadelphia 32, Pa.
Keystone Valve Corp., P. O. Box 6716, 5325 Kirby Dr., Houston 5, Texas.
Kidde & Co., Inc., Walter, 956 Main St., Belleville 9, N. J.
Kieley & Mueller, Inc., 64 Gemung St., Middletown, N. Y.
Killark Electric Mfg. Co., 3940 Easton Ave., St. Louis, Mo.
Kintel, 5725 Kearny Villa Rd., San Diego, Calif.
Kirk & Blum Mfg. Co., 3150 Forrer St., Cincinnati 9, Ohio.
Kistler Instrument Corp., North Tonawanda, N. Y.
Klemp Metal Grating Corp., 6613 S. Melvina Ave., Chicago 38, Ill.
Klipfel Valves, Inc., 1075 Lincoln Ave. Hamilton, Ohio.
Klochner-Humboldt-Eeutz AG, Cologne, Germany.
Knopp, Inc., 1307 66th St., Oakland 8, Calif.
Kobe, Inc., 3040 E. Slauson Ave., Huntington Park, Calif.
Koebel Diamond Tool Co., 9456 Grinnell, Detroit 13, Mich.
Koehring Co., 3026 West Concordia, Milwaukee 16, Wis.
Kolton Electric Mfg. Co., 123 New Jersey R. R. Ave., Newark 5, N. J.
Koppers Co., Inc., Metal Prod Div., 200 Scott St., Baltimore 30, Md.
Koppers Co. Inc., Koppers Bldg., Pittsburgh 19, Pa.
Korb-Pettit Wire Fabrics & Iron Works. 1501-15 N. Mascher St., Philadelphia 22, Pa.
Kraft Bag Corp., 630 Fifth Ave., New York, N. Y.
Kremser & Sons, Inc., Frank A. P. O. Box 6207 Holmesburg Sta., Philadelphia 36, Pa.
Krogh Pump & Equipment Co., Inc., 515 Harrison St., San Francisco 5, Calif.
Kuhlman Electric Co., P. O. Box 288, Birmingham, Mich.
Kurz & Root Co., 232 E. North Island St., Appleton, Wis.
Kwik-Mix Co., Koehring Div., 235 W. Grand Ave., Port Washington, Wis.
K. W. Battery Co., 3555 Howard St., Skokie, Ill.
KW-DART TRUCK CO., 1301 N. Manchester Trfwy, Kansas City 20, Mo. P403

L

Laclede-Christy Works, Refractories Div., H. K. Porter Co., Inc., 2500 First National Bank Bldg., Pittsburgh 22, Pa.
Ladish Co., Cudahy, Wis.
Lafayette Radio Corp., 165 Liberty Ave., Jamaica 33, N. Y.
Laniere De Sclessin, Sclessin, Belgium.
Lake Shore, Inc., Lake Shore Engineering Div., Iron Mountain, Mich.
Lake Shore Electric Mfg. Corp., 207 Willis St., Bedford, Ohio.
Lakeside Bridge & Steel Co., 5306 North 33rd St., Milwaukee 9, Wis.
Lamson Corp. 210 Lamson St., Syracuse 1, N. Y.
Lamson & Sessions Co., 5000 Tiedeman Rd., Cleveland 9, Ohio
Landis Steel Co., 116 West A St., Box 248, Picher, Okla.
Laramie Chemical Corp., 290 Main St., Stamford, Conn.
Laubenstein Mfg. Co., 422 S. Third St., Ashland, Pa.
LAWRENCE PUMPS, INC., 371 Market St., Lawrence, Mass. P334
Laylander, Philip A., Box 4395, Tucson, Ariz.
Layne & Bowler Pump Co. of Los Angeles, 2943 South Vail Ave., Los Angeles 22, Calif.
Leavitt Machine Co., Orange, Mass.
Lebanon Steel Foundry, Lebanon, Pa.
Le Bus International Engineers, Inc., Box 23525 Longview, Tex.
Lebus Mfg. Co., Subsidiary of American Hoist & Derrick Co., Longview, Texas.
Lecco Machinery & Engineering Co., Box 3036, Bluefield, West Va.
Lecourtenay Co., 5 Maine St., Newark 5, N. J.
Ledoux & Co., Inc., 359 Alfred Ave., Teaneck, N. J.
LECTROMELT FURNACE DIV., McGRAW-EDISON CO. P. O. Box 1257, Pittsburgh 30, Pa. P148
Ledeen, Inc., 3350 North Gilman Rd., El Monte, Calif.
Leeds & Northrup Co., 4970 Stenton Ave., Philadelphia 44, Pa.
Lee-Norse Co., 751 Lincoln Ave., North Charleroi, Pa.
Leetonia Tool Co., 142 Main St., Leetonia, Ohio.
Leffel & Co., James, 426 East St., Springfield, Ohio.
LE-HI Div., Hose Accessories Co., 17th St. & Lehigh Ave., Philadelphia 32, Pa.
Leland Electric Co., Div. American Machine & Foundry Co., 1501 Webster St., Dayton 1, Ohio.
LE ROI DIV., WESTINGHOUSE AIR BRAKE CO., Milwaukee 1, Wis. P401
LESCHEN WIRE ROPE DIV., H. K. PORTER COMPANY, Inc., 2727 Hamilton Ave., St. Louis 12, Mo. P346
LE TOURNEAU-WESTINGHOUSE CO., P. O. Box 240, Peoria, Ill. PP17-20
LeTourneau, Inc., R. G. 4014 S. MacArthur St., Longview, Texas.
Leupold & Stevens Instruments, Inc., 4445 N. E. Glisan St., Portland 13, Ore.
Lewellen Mfg. Co., 1428 Tenth St., Columbus, Ind.
Lewis Bolt & Nut Co., 504 Malcolm Ave., S. E., Minneapolis 14, Minn.
Lidgerwood Industries, Inc., 7 Dey St., New York, N. Y.
Lilie-Hoffman Cooling Towers, Inc. 1450 S. Vandeventer, St. Louis 10, Mo.
Lima Electric Motor Co., Findlay Rd., Lima, Ohio.
LINATEX CORP. OF AMERICA, Stafford Springs, Conn. P167
Lincoln Electric Co., 22801 St. Clair Ave., Cleveland 17, Ohio.
Lincoln Engineering Co. Div., McNeil Machine & Engineering Co., 5701 Natural Bridge, St. Louis 20, Mo.
Linde Co., Union Carbide Corp., 30 East 42 St., New York 17, N. Y.
Line Material Industries, McGraw-Edison Co., 700 W. Michigan St., Milwaukee 1, Wis.
LINK-BELT CO., DEPT. EMJ-58, Prudential Plaza, Chicago 1, Ill. P83
Link-Belt Speeder Corp., 1201 6th St., S.W., Cedar Rapids, Iowa.
Lippmann Engineering Works, Inc., 4603 W. Mitchell St., Milwaukee, Wis.
Liquid-Solid Separations, Ltd., 2 Anderson St., London S.W. 3, England.
Lister-Blackstone, Inc., 42-32 21st St., Long Island City 1, N. Y.
Lockrey Co., Lubricants Div., Southampton, N. Y.
Lonergan Co., J. E., Second & Race Sts., Philadelphia 6, Pa.
LOGAN ENGINEERING CO., 4901 West Lawrence St., Chicago 30, Ill. P186
Long Co., Box 331, Oak Hill, W. Va.
Longyear Co., E. J., 1700 Foshay Tower, Minneapolis 2, Minn.
Los Angeles Steel Casting Co., 6100 South Boyle, Los Angeles 58, Calif.
Louden Machinery Co., 607 Broadway, Fairfield, Iowa.
Lovejoy Flexible Coupling Co., 4932 W. Lake St., Chicago 44, Ill.
Ludwig Inc., F. G., 105 Coulter St. Old Saybrook, Conn.
Ludlow-Saylor Wire Cloth Co., 634 S. Newstead, St. Louis 10, Mo.
Lufkin Rule Co., 1730 Hess Ave., Saginaw, Mich.
LUKENS STEEL CO., Coatesville, Pa. P377
Lumen Bearing Co., 197 Lathrop St., Buffalo 12, N. Y.
Lundberg Explorations, Ltd., 96 Eglinton Ave. E., Toronto, Ontario, Canada.
Lunkenheimer Co., Beekman St. & Waverly Ave., Cincinnati 14, Ohio.
Luzerne Rubber Co., Muirhead & Dewey Sts., Trenton 7, N. J.

M

Macbeth Daylighting Corp., Newburgh, N. Y.
MACE CO., 2763 Blake St., Denver 5, Colo. P419
MACHINERY CENTER INC., P. O. Box 964—1201 South 6th West, Salt Lake City 10, Utah. P400
MACK TRUCKS INC., 1355 West Front St., Plainfield, N. J. P411
Macklin Co., 1936 Lawrence Blvd., Jackson, Mich.
Macwhyte Wire Rope Co., 2937 14th Ave., Kenosha, Wis.
Madesco Tackle Block Co., Easton, Pa.
Magnetic Engineering & Mfg. Co., 852 Van Houten Ave., Clifton, N. J.
MAGOR CAR CORP., 50 Church St., New York 7, N. Y. P74
Mahon Co. R. C., P. O. Box 4666, Detroit 34, Mich.
Majac, Inc., 23rd St., Sharpsburg, Pittsburgh 15, Pa.
Mallinckrodt Chemical Works, 2nd & Mallinckrodt Sts., St. Louis 7, Mo.
MANCHA STORAGE BATTERY LOCOMOTIVE DIV., GOODMAN MFG. CO., Halsted St. & 48th Pl., Chicago 9, Ill. P12
Manganese Steel Forge Co., Allen St. & Castor Ave., Philadelphia 34, Pa.
Manheim Mfg. & Belting Co., 470 Stiegel St., Manheim, Pa.
MANITOWOC ENGINEERING CORP., South 16th St., Manitowoc, Wis. P44
Manning Co., Charles E., 4700 Clairton Blvd., Pittsburgh, Pa.
Manning, Maxwell & Moore, Inc., Shaw Box Crane & Hoist Div., Muskegon, Mich.
Manu-Mine Research & Devel. Co., P. O. Box 167, Reading, Pa.
Manzel Div., Houdaille Industries, Inc., 315 Babcock St., Buffalo 10, N. Y.
Marathon Coal Bit Co., Inc., Montgomery, W. Va.
Marathon Corp., Chemical Sales Dept., Rothschild, Wis.
Marathon Electric Mfg. Corp., Wausau, Wis.
Marble Electric Corp., Superior St, Gladstone, Mich.
Marietta Concrete Corp., Dept. B, Marietta, Ohio.
Marion Metal Products Co., Cheney Ave., Marion, Ohio.
MARION POWER SHOVEL CO., Marion, Ohio. P387
Markley Dust Control System, Inc., 80 Snyder Rd., Ramsey, N. J.
Maryland One-Way Clutch Co., Elm Ave. & Washington St., La Grange, Ill.
Marley Co., 222 West Gregory Blvd., Kansas City 14, Mo.
Marlin-Rockwell Corp., 402 Chandler St., Jamestown, N. Y.
Marlow Pumps Div., Bell & Gossett Co., Box 200, Midland Park, N. J.
Marmon-Herrington Co., 1511 West Washington St., Indianapolis 7, Ind.
Marquette Mfg. Co., Inc., 307 E. Hennepin Ave., Minneapolis 14, Minn.
Marsh Engineering Co., E. F., 4324 W. Clayton Ave., St. Louis 10, Mo.
Martin Engineering Co., Neponset, Ill.
Martin Fan & Blower Co., 4634 W. 21st Pl., Chicago 50, Ill.
Marvel Engineering Co., 7227 N. Hamlin Ave., Chicago 45, Ill.
Maschinenfabrik Rudolf Hausherr & Soehne, GmbH, c/o B. J. Nykerk Corp., 42 Broadway, New York 4, N. Y.
Massachusetts Gear & Tool Co., Div. of Geartronics Corp., 46 Nashua St., Woburn, Mass.
Master Bronze Powder Co., Inc., 538-548 West State St., Calumet City, Ill.
Master Builders Co., 7016 Euclid Ave., Cleveland 3, Ohio.
Master Electric Co., Div. Reliance Electric & Engineering Co., 126 Davis Ave., Dayton 1, Ohio.
Master Mfg. Co., Hutchinson, Kan.
Matronics, Inc., New York, N. Y.
MAXI CORP., P. O. Box 3129 Terminal Annex, Los Angeles 54, Calif.
MAYHEW MACHINE DIV. (GARDNER-DENVER CO.) P. O. Box 7726, Dallas, Tex. PP30-31
Mayo Tunnel & Mine Equipment, Box 1413, Lancaster, Pa.
McClintock Co., R. S., W. 418 Second Ave., Spokane, Wash.
McDonald Drilling Co., Inc., 14408 St. Marys Ave., Detroit 27, Mich.
McDonald Mfg. Co., A. Y., 12th & Pine Sts., Dubuque, Iowa.

McDowell Co., Inc., 113 St. Clair Ave. N.E., Cleveland 14, Ohio.
McDowell Mfg. Co., Pittsburgh 9, Pa.
McGill Mfg. Co., Inc., 1151 N. Lafayette St., Valparaiso, Ind.
ABCs Scale Div., McDowell Co., Inc., 16300 Waterloo Rd., Cleveland 10, Ohio.
McGowan Pump Div., Leyman Mfg. Corp., 3401 Central Parkway, Cincinnati 25, Ohio.
McGowan Pump Div., Leymann Mfg. Corp., 58 Central Ave., Cincinnati 2, Ohio.
LECTROMELT FURNACE DIV., McGRAW-EDISON CO., P. O. Box 1257, Pittsburgh 30, Pa. P148
McKee & Co., Arthur G., 2300 Chester Ave., Cleveland 1, Ohio.
McKenzie & Whittle, Carlsbad, N. M.
McKiernan-Terry Corp., 505 Manor Ave., Harrison, N. J.
McKinney Drilling Co., P. O. Box 190, Nacogdoches, Tex.
McLANAHAN & STONE CORP., Hollidaysburg, Pa. P372
McMillan's Sons, W. H., 49 South St., New York, N. Y.
McNALLY PITTSBURG MFG. CORP., 307 W. Third St., Pittsburg, Kan. P169
McPhar Geophysics, Ltd., 139 Bond Ave., Don Mills, Ontario, Canada.
McPhar Manufacturing, Ltd., 139 Bond Ave., Don Mills, Ontario, Can.
Mead Mill Co., 14736 Charlevoix Ave., Detroit 15, Mich.
Meckum Engineering, Inc., 53 W. Jackson Blvd., Chicago 4, Ill.
Meckum Engineering, Inc., Dayton Rd., Ottawa, Ill.
Meeker Foundry Co., 95 Clay St., Newark 4, N. J.
Memco Engineering & Mfg. Co., Commack, N. Y.
Menlo Research Laboratory, 538 Phelan Ave., San Jose, Calif.
Meriam Instrument Co., 10920 Madison Ave., Cleveland 2, Ohio.
MERRICK SCALE MFG. CO., 184 Autumn St., Passaic, N. J. P196
Metal Carbides Corp., 6001 Southern Blvd., Youngstown 12, Ohio.
Metal & Thermit Corp., Rahway, N. J.
Metal Traders Inc., 67 Wall St., New York, N. Y.
Metallizing Engineering Co., Inc., 1101 Prospect Ave., Westbury, N. Y.
Metallo Gasket Co., 12 Bethany St., New Brunswick, N. J.
Metallurgical Products Dept., General Electric Co., 11177 East Eight Mile Rd., Detroit 32, Mich.
Metron Instrument Co., 432 Lincoln St., Denver, Colo.
Mexico Refractories Co., Mexico, Mo.
Michigan Chemical Corp., Saint Louis, Michigan.
Micro Switch Div., Minneapolis-Honeywell Regulator Co., Freeport, Ill.
Midvale-Heppenstall, 4320 Wissahickon Ave., Philadelphia 40, Pa.
Miehle Printing Press & Mfg. Co., Star-Kimble Motor Div., P. O. Box 904, c/o Safety Industries, New Haven 4, Conn.
Miller & Associates, David, Box 572 Beverly Hills, Calif.
Miller Equipment Co., Inc., 13 & New Sts., Franklin (Venango County), Pa.
Milwaukee Electric Tool Corp., 5316 W. State St., Milwaukee 8, Wis.
MINE & SMELTER SUPPLY CO., Marcy Mill Div., P. O. Box 9041, Denver 16, Colo. PP80-81
MINE SAFETY APPLIANCES CO., 201 North Braddock Ave., Pittsburgh 8, Pa. P185
Minerals Engineering Co., 801 Fourth Ave., Grand Junction, Colo.
Miners' Hardware Supply Co., 806 Republic Bldg., Pittsburgh 12, Pa.
Mining Machine Parts, Inc., 2701 St. Clair Ave., Cleveland 14, Ohio.
MINNEAPOLIS - HONEYWELL REGULATOR CO., INDUSTRIAL DIV., Wayne & Windrim Aves., Philadelphia 44, Pa. P437
MINNEAPOLIS - HONEYWELL REGULATOR CO., 2753 Fourth Ave., S., Minneapolis 8, Minn.
MINNEAPOLIS - HONEYWELL REGULATOR CO., BROWN INSTRUMENT DIV., Wayne & Windrim Aves., Philadelphia 44, Pa.
Minnesota Mining & Mfg. Co., 900 Bush Ave., St. Paul 6, Minn.
MISSION MFG. CO., P. O. Box 4209, Houston, Texas. P123
Missouri Belting Co., 1029 S. Grand Blvd., St. Louis 4, Mo.
MIXING EQUIPMENT CO., 234-n Mt. Read Blvd., Rochester 11, N. Y. P385
Mobile Aerial Towers, Inc., Ft. Wayne, Ind.
MOBILE DRILLING, INC., 960 N. Pennsylvania St., Indianapolis 4, Ind. PP179-180
MOBILE DRILLING & ENGINEERING INC., DIV. MOBILE DRILLING INC. 960 N. Pennsylvania St., Indianapolis 4, Ind.
MOBILE BUMPER INC., DIV. MOBILE DRILLING INC., 960 N. Pennsylvania St., Indianapolis 4, Ind.
Moloney Electric Co., 5390 Bircher Blvd., St. Louis 20, Mo.
Monsanto Chemical Co., 800 N. Lindburgh Blvd., St. Louis 66, Mo.
Moore Co., 424 Nichols Rd., Kansas City 12, Mo.
Moore Co., 1036 Quarrier St., Charleston, W. Va.
Moore Drop Forging Co., 38 Walter St., Springfield 7, Mass.
Moran Engineering Co., 7721 E. Jefferson St., Paramount, Calif.
Morco, Inc., 22201 Aurora Rd., Bedford, Ohio.
Morgardshammars Mak Verkstads, Morgardshammar, Sweden.
MORRIS MACHINE WORKS, Baldwinsville, N. Y. P72
Morse Bros. Machinery Co., P. O. Box 1708, Denver, Colo.
Morse Chain Co., A Borg-Warner Industry, Ithaca, N. Y.
Morton Salt Co., 110 N. Wacker Drive, Chicago 6, Ill.
Motorola Communications & Electronics, Inc., 4501 Augusta Blvd., Chicago 51, Ill.
Mott Core Drilling Co., 830 Eighth Ave., Huntington, W. Va.
Mueller Brass Co., 1925 Lapeer Ave., Port Huron, Mich.
Multi Electrical Mfg. Co., 4243 W. Lake St., Chicago 24, Ill.
Multi-Metal Wire Cloth Co., Inc., 1350 Garrison Ave., New York 59, N. Y.
MULLITE WORKS, REFRACTORIES DIV. H. K. PORTER COMPANY, INC., Canal St., Shelton, Conn.
Murphy Diesel Co., 5317 W. Burnham St., Milwaukee 11, Wis.
Mustang Motor Products Corp., Box 1191, 635 West Colorado Blvd., Glendale 4, Calif.
Myers-Whaley Co., Inc., P. O. Box 789, Knoxville 1, Tenn.

N

NACHOD & U. S. SIGNAL CO., 4777 Louisville Ave., Louisville 9, Ky. P439
NAGLE PUMPS, INC., 1239 Center St., Chicago Heights, Ill. P422
Nash Engineering Co., 218 Wilson Rd., South Norwalk, Conn.
National Carbon Co., Union Carbide Corp., 30 East 42 St., New York 17, N. Y.
National Cylinder Gas, Div. Chemetron Corp., 840 N. Michigan Ave., Chicago 11, Ill.
National Electric Products Corp., Gateway Center, 140 Stanwix St., Pittsburgh 22, Pa.
NATIONAL FILTER MEDIA CORP., 1717 Dixwell Ave., New Haven 11, Conn. P386
National Fuse & Powder Co., 3801 Delgany St., Denver 5, Colo.
NATIONAL IRON CO., 50th Ave. W. & Ramsey St., Duluth 7, Minn. P175
National Lead Co., 111 Broadway, New York 6, N. Y.
NATIONAL MINE SERVICE CO., 1260 Maple St., Indiana 19, Pa. P165
NATIONAL MALLEABLE & STEEL CASTINGS CO., 10606 Quincy Ave., Cleveland 6, Ohio. PP166,343
National Powder Co., Eldred, Pa.
NATIONAL SUPPLY CO., Two Gateway Center, Pittsburgh, Pa. P354
National Tank & Pipe Co., 2301 N. Columbia Blvd., Portland 3, Ore.
National Vulcanized Fibre Co., Box 311, Wilmington 99, Del.
National Welding & Mfg. Co., 690 Cedar St., Newington, Conn.
NAYLOR PIPE CO., 1243 E. 92nd St., Chicago 19, Ill. P181
Neff & Fry Co., Camden, Ohio.
New Departure Div., General Motors Corp., Bristol, Conn.
New Jersey Meter Co., Plainfield, N.J.
New Jersey Zinc Co., 160 Front St., New York 38, N. Y.
New York Air Brake Co., Aurora Pump Div., 86 Loucks St., Aurora, Ill.
New York Belting & Packing Co., 1 Market St., Passaic, N. J.
NEW YORK ENGINEERING CO., 75 West St., New York 6, N. Y. P324
New York & New Jersey Lubricant Co., 292 Madison Ave., New York 17, N. Y.
New York Rubber Corp., 100 Park Ave., New York 17, N. Y.
Newage Industries, Inc., 222 York Road 20, Jenkintown, Pa.
Newark Wire Cloth Co., 370 Verona Ave., Newark 4, N. J.
Newcomer Products, Inc., Latrobe, Pa.
Newhall Chain Forge & Iron Co., 11 Orchard Rd., Park Ridge, N. J.
Nice Ball Bearing Co., 30th & Hunting Park Ave., Philadelphia 40, Pa.
Nichols Laboratories, Inc. 160 S. W. Temple St., Salt Lake City 1, Utah.
NICHOLS ENGINEERING & RESEARCH CORP., 70 Pine St., New York 5, N. Y. P335
Nife, Inc., Lambert Ave., Copiague, N. Y.
Nolan Co., 120 Pennsylvania St., Bowerston, Ohio
NORDBERG MFG. CO., 3073 S. Chase Ave., Milwaukee 1, Wis. PP42-43
Norden-Ketay Corp., Milford, Conn.
Norma-Hoffman Bearings Corp., Stamford, Conn.
North American Philips, Co., Inc. 750 South Fulton Ave., Mount Vernon, N. Y.
North American Refractories Co., E. 6th at Euclid Ave., Cleveland 14, Ohio.
NORTHERN BLOWER CO., 6410 Barberton Ave., Cleveland, Ohio. P360
Northern Conveyor Co., P. O. Box 46, Janesville, Wis.
NORTHWEST ENGINEERING CO., 135 S. La Salle St., Chicago 3, Ill. P13
Northwestern Electric Co., 1750 N. Springfield Ave., Chicago 47, Ill
Norton Co., 1 New Bond St., Worcester 6, Mass.
Novo Pump & Engine Co., 702 Porter St., Lansing 5, Mich.
Nuclear-Chicago Corp., 223 W. Erie St., Chicago, Ill.
Nuclear Exploration Co., 826 East 7th St., Los Angeles 21, Calif.
Nuclear Research Corp., Second St. Pike, Southampton, Pa.

O

O. K. Machinery Div., John C. Motter Printing Press Co., Columbia, Pa.
Ogden Iron Works, 185 23 St., Ogden, Utah.
Ohio Brass Co., Mansfield, Ohio.
Ohio Carbon Co., 12508 Berea Rd., Cleveland 11, Ohio.
Ohio Forge & Machine Corp., 3010 Woodhill Rd., Cleveland 4, Ohio.
Ohio Gear Co., 1333 E. 179th St., Cleveland 10, Ohio.
Ohio Grease Co., 525 N. Spring St., Loudonville, Ohio.
Ohio Injector Co., 275 Main St., Wadsworth, Ohio.
Ohio Locomotive Crane Co., 1816 Southern Ave., Bucyrus, Ohio.
Ohio Oil Co., 539 South Main St., Findlay, Ohio.
Oilgear Co., 1605 W. Pierce St., Milwaukee 4, Wis.
Okadee Co., 332 S. Michigan Ave., Chicago 4, Ill.
Okonite Co., Subsidiary Kennecott Copper Corp., 220 Passaic St., Passaic, N. J.
Olds Alloy Co., 4481 Mason St., South Gate, Calif.
Olin-Mathieson Chemical Corp., Explosive Div., East Alton, Ill.
Oliver Corp., 400 West Madison, Chicago 6, Ill.
Oliver Corp., A. B. Farquhar Div., 142 N. Duke St., York, Pa.
Onan & Sons, Inc., D. W. University Ave., S. E. at 25th, Minneapolis 14, Minn.
OPW-Jordan, Div. OPW Corp., 6013 Wiehe Rd., Cincinnati 13, Ohio.
Ore & Chemical Corp., 80 Broad St., New York, N. Y.
Orange Roller Bearing Co., Inc., 557 Main St., Orange, N. J.
Organist Petrographic Laboratory, D. M., Box 176, Newark, Delaware.
Oronite Chemical Co., 200 Bush St., San Francisco, Calif.
Orton Crane & Shovel Co., 608 S. Dearborn St., Chicago 5, Ill.
Ortruc, Inc., Mount Carmel, Illinois.
Osborn Manufacturing Co., Hamilton & Marquette Sts., Cleveland 14, Ohio.
Oshkosh Motor Truck, Inc., 2300 Oregon St., Oshkosh, Wis.
Omose Wood Preserving Co., 980 Ellicott St., Buffalo 9, N. Y.
Ottumwa Box Car Loader Co., Ottumwa, Iowa.
Overseas Raw Materials Corp., 11 Broadway, New York, N. Y.
Overstrom & Sons, Inc., 2213 West Mission Rd., Alhambra, Calif.
Owatonna Tool Co., 353 Cedar St., Owatonna, Minn.
Owen Bucket Co., 6001 Breakwater Ave., Cleveland 2, Ohio.
Oxy-Catalyst, Inc., Wayne, Pennsylvania.
Ozalid Div., General Aniline & Film Corp., Ansco Rd., Johnson City, N. Y.

P

Pacific Coast Engineering Co., Oak and Clement Sts., Alameda, Calif.
Pacific Foundry Co., Ltd., 3100—19th St., San Francisco 10, Calif.
Packsack Diamond Drills, Ltd., 1385 Hammond St., North Bay, Ontario, Canada.
Pacific Lumber Co., 100 Bush St., San Francisco, Calif.
Pacific Wire Rope Co., 1840 E. 15th St., Los Angeles 21, Calif.
Pacific Wood Tank Corp., 461 Market St., San Francisco 5, Calif.
Page Engineering Co., Clearing Post Office, Chicago 38, Ill.
Palnut Co., Glen Rd., Mountainside, N.J.
Pangborn Corp., 630 Pangborn Blvd., Hagerstown, Md.
Paragon Electric Co., 1600 12 St., Two Rivers, Wis.
Paragon-Revolute Corp., 77 South Ave., Rochester 4, N. Y.
Parker Electrical Mfg. Co., 221 Washington St., Oakland 7, Calif.
Parker Safety Equipment Co., 785 Iyons Ave., Irvington 11, N. J.
Partrick & Wilkins Co., 51 N. 7th St., Philadelphia 6, Pa.
Patterson Foundry & Machine Co. Div. Ferro Corp., P. O. Box 743, East Liverpool, Ohio.
Pattin Manufacturing Co., P. O. Box 527, Marietta, Ohio.
Patton Mfg. Co., Inc., 1802 W. Pleasant St., Springfield, Ohio.
Paulsen-Webber Cordage Corp., 170 John St., New York N. Y.
Pease Co., C. F. 2601 W. Irving Park Rd., Chicago, Ill.
Peck & Harvey Mfg. Corp., 5650 North Western Ave., Chicago 45, Ill.
Peerless Electric Co., 1401 W. Market St., Warren Ohio.
Peerless Photo Products, Inc., Shoreham, N. Y.
Penberthy Mfg. Co., 1242 Holden Ave., Detroit 2, Mich.
Pendleton Woolen Mills, P. O. Box 655, Washougal, Wash.
Peninsular Grinding Wheel Div., 729 Meldrum Ave., Detroit 7, Mich.
Penn Machine Co., 106 Station St., Johnstown, Pa.
Penn Mfg. & Supply Co., 45 Westminster St., Wilkes-Barre, Pa.
Pennsalt Chemicals Corp., 3 Penn Center, Philadelphia 2, Pa.
Pennsylvania Crusher Div., Bath Iron Works Corp., Rm. 1712, West Chester, Pa.
Pennsylvania Drilling Co., 1201 Chartiers Ave., Pittsburgh 20, Pa.
Pennsylvania Pump & Compressor Co., Easton, Pa.
Perkin Engineering Corp., 345 Kansas St., El Segundo, Calif.
Perkins Machine & Gear Co., West Springfield, Mass.
Permagile Corp. of America, 34-43 56th St., Woodside 77, N. Y.
Permold Co., 800 W. Liberty St., Medina, Ohio.
PERMUTIT CO., DIV., PFAUDLER PERMUTIT, INC., 50 W. 44th St., New York 36, N. Y.
Peterson Filters & Engr. Co., 1949 S. 2nd W. Salt Lake City, Utah.
Pettibone Mulliken Corp., 4710 W. Division St., Chicago 51, Ill.
Pettinos, Inc., George F., 1206 Locust St., Philadelphia 7, Pa.
PHELPS DODGE COPPER PRODUCTS CORP., 300 Park Ave., New York 22, N. Y. P396
Philadelphia Belting Co., 6th & Spring Garden Sts., Philadelphia 23, Pa.
PHILADELPHIA GEAR CORP., G St. & Erie Ave., Philadelphia 34, Pa. P176
PHILADELPHIA QUARTZ CO., 1135 Public Ledger Bldg., Philadelphia 6, Pa. P419
Philipp Bros., Inc., 70 Pine St., New York 5, N. Y.
Philips Electronics, Inc., Instruments Div., 750 S. Fulton Ave., Mt. Vernon, N. Y.
Phillips Petroleum Co., Bartlesville, Okla.
Phoenix Products Co., Inc., 4735 N. 27th St., Milwaukee, Wis.

Pickard Industries, Inc., Central Mine Supply Co., Div., Mt. Vernon, Ill.
Pioneer Engineering Div., Poor & Co. Inc., 3200 Como Ave., Minneapolis 14, Minn.
Pitkin, Inc., Lucius, 47 Fulton St., New York 38, N. Y.
Pitnam Electric Products Co., Pirelli Power Cable Dept., 261 Madison Ave., New York 16, N. Y.
Pitman Mfg. Co., 300 W. 79 Terrace, Kansas City 14, Mo.
Pittsburgh Electrical & Machine Works, 1130 N. Franklin St., Pittsburgh 33, Pa.
Pittsburgh Gear Co., Neville Island, Pittsburgh 25, Pa.
Pittsburgh Reflector Co., Oliver Bldg., Pittsburgh 22, Pa.
Pittsburgh Steel Co., 1600 Grant Bldg., Pittsburgh 30, Pa.
Plan Hold Corp., 5204 Chakemco St., South Gate, Calif.
Plastex Co., 3232 Cleveland Ave., Columbus 24, Ohio.
Plymouth Locomotive Works Div., Fate-Root-Heath Co., Plymouth, Ohio
Plymouth Rubber Co., 51 Revere St., Canton, Mass.
Pollock Co. William B., 101 Andrews Ave., Youngstown, Ohio.
Poole Foundry & Machine Co., 1700 Union Ave., Baltimore 11, Md.
Porcelain Div., Ferro Corp., P. O. Box 743, East Liverpool, Ohio.
Porta-Trace, Inc., 342 Clinton Street, Binghamton, New York.
Porto Pump Inc., 19735 Ralston, Detroit 3, Mich.
Porter-Cable Machine Co., 700 Marcellus St., Syracuse 4, N. Y.
Post Co., Frederick, 3650 N. Avondale Ave., Chicago 18, Ill.
Powell Co., Wm., 2525 Spring Grove Ave., Cincinnati 22, Ohio.
Powercraft Corp., 2215 De Kalb St., St. Louis 4, Mo.
Precision Grinding Wheel Co., Inc., 8301 Torresdale Ave., Philadelphia 36, Pa.
Precision Radiation Instruments, Inc., 4223 West Jefferson Blvd., Los Angeles 16, Calif.
Precision Thermometer & Instrument Co., 1434 Brandywine St., Philadelphia 30, Pa.
Preco Inc. 6300 E. Slauson Ave., Los Angeles 22, Calif.
Prehy Co., 420 Lexington Ave., New York 17, N. Y.
Prime Mover Co., Muscatine, Iowa.
Princeton Gripholst, Inc., 32 George St., Boston 19, Mass.
Prins & Associates, K., Wellston, Ohio.
Process Engineering, Inc., Foot of Chase St., Methuen, Mass.
Product Development Co., Inc., 307 Bergen Ave., Kearny, N. J.
Productive Equipment Corp., 2926 W. Lake St., Chicago 12, Ill.
Proto Tool Co., 2209 Santa Fe Ave., Los Angeles 58, Calif.
Frank Prox Co., Inc., Terre Haute, Ind.
Pulmosan Safety Equipment Corp., 644 Pacific St., Brooklyn, N. Y.
Pulva Corp., 602 High St., Perth Amboy, N. J.
Pulverizing Machinery Div., Metals Disintegrating Co., Inc., Chatham Rd., Summit, N. J.
Punch-Lok Co., 321 North Justine St., Chicago 7, Ill.
Pure Carbon Co., 441 Hall Ave., St. Marys, Pa.
Pure Oil Co., 35 E. Wacker Drive, Chicago 1, Ill.
Purolator Products, Inc., 970 New Brunswick Ave., Rahway, N. J.
Pyle-National Co., 1328 N. Kostner Ave., Chicago 51, Ill.

Q

Quaker Rubber Div., H. K. Porter Co., Tacony & Comly Sts., Philadelphia 24, Pa.
Quay Industries, 2135 Riverside Avenue, Jacksonville 4, Fla.
Queen City Machine Tool Co., 3900 Kellogg Ave., Cincinnati 26, Ohio.
Quick Charge, Inc., 1750 N. E. 10th St., Oklahoma City, Okla.
Quick-Way Truck Shovel Co., P. O. Box 1800, Denver 1, Colo.
Quigley Co., Inc., 415 Madison Ave., New York 17, N. Y.

R

Radiac Co., Inc., 489 Fifth Ave., New York 17, New York.
Radiation Counter Laboratories, 5121 W. Grove St., Skokie, Ill.
Radio Corp. of America, Communications Products Dept., Camden 2, N. J.
Rankin Manufacturing Co., 616 S. Marengo Ave., Alhambra, Calif.
Rattan Mfg. Co., 550 State St., New Haven 7, Conn.
Rawson Electrical Instrument Co., 102 Potter St., Cambridge 42, Mass.
Ray-O-Vac Co., Div. Electric Storage Battery Co., 212 E. Washington Ave., Madison 10, Wis.
RAYBESTOS-MANHATTAN, INC., MANHATTAN RUBBER DIV., 42 Townsend St., Passaic, N. J. PP92-93
Reading Crane & Hoist Corp., Box 1139 Reading Pa.
Ready Power Co., 11231 Freud Ave., Detroit Mich.
RED JACKET CO., INC., 500 Bell Ave., Carnegie, Pa. P416
Reed-Curtis Nuclear Industries, Inc., 655 W. Washington Blvd., Los Angeles 15, California.
Reed Roller Bit Co., Box 2119, Houston 1, Tex.
Reeves Pulley Co., Div., Reliance Electric & Engineering Co., 1225 Seventh St., Columbus, Ind.
Refractory & Insulation Corp., 120 Wall St., New York 5, N. Y.
REICHDRILL DIV. CHICAGO PNEUMATIC DRILL TOOL CO., 1439 Ash St., Terre Haute, Indiana, PP188-189
Reintjes Co., George P., 2519 Jefferson St., Kansas City 6, Mo.
Reilly Tar & Chemical Corp., Merchants Bank Bldg., Indianapolis 4, Ind.
Reliance Electric & Engineering Co., 24701 Euclid Ave., Cleveland 17, Ohio.
Remington Arms Co., Inc., 939 Barnum Ave., Bridgeport 2, Conn.
Reo Div., White Motor Co., 1331 S. Washington St., Lansing 20, Mich.
Remington Rand Div., Sperry Rand Corp., 315 Fourth Ave., New York 10, N. Y.
Republic Flow Meters Co., 2240 Diversey Pkwy., Chicago 47, Ill.
Republic Rubber Div., Lee Rubber & Tire Corp., Albert St., Youngstown, Ohio.
REPUBLIC STEEL CORP., Republic Bldg., Cleveland 1, Ohio.
Republic Steel Corp., Truscon Steel Div., Albert St., Youngstown 1, Ohio.
Research-Cottrell, Inc., Bound Brook, N. J.
Resisto-Loy Co., Inc., 1251 Phillips Ave., S. W., Grand Rapids 7, Mich.
Resources Development Corp. , 1640 Court Place, Denver, Colo.
Revere Copper & Brass, Inc., 230 Park Ave., New York 17, N. Y.
Revere Corp. of America, Wallingford, Conn.
Reynolds Metals Co., P. O. Box 2346-ZK, Richmond 18, Va.
Rhoads & Son, J. E., 2100 W. Eleventh St., Wilmington 99, Del.
RIBLET TRAMWAY CO., 1231 N. Washington St., Spokane, Wash. P416
Rice Pump & Machine Co., Belgium, Wis.
Richards-Wilcox Mfg. Co., 1176—3rd St., Aurora, Ill.
Richardson Scale Co., Clifton, N. J.
Ridge Equipment Co., Fallentimber, Pa.
RIDGE TOOL CO., 400 Clark St., Elyria Ohio. P344
Robbins Machine & Manufacturing Co., Inc.
Robbins & Myers, Inc., 1345 Lagonda Ave., Springfield, Ohio.
Roberts & Schaefer Co., Subsidiary of Thompson Starrett Co., Inc., Randolph-Wells Bldg., 130 North Wells St., Chicago 6, Ill.
Robinson Air-Activated Conveyor Systems, 80 Fifth Ave., New York 11, N. Y.
Robinson Clay Product Co., 65 West State St., Akron 9, Ohio.
Robinson Ventilating Co., Zelienople, Pa.
Rochester Ropes, Inc., Culpeper, Va.
Rockbestos Products Corp., Nicoll & Canner Sts., New Haven 4, Conn.
Rockford Bolt & Steel Co., 126 Mill St., Rockford, Ill.
Rockiron Co., Ltd., Sudbury, Ontario, Canada
Rockwell Co., W. S., 200 Eliot St., Fairfield, Conn.
Rockwell Mfg. Co., 400 N. Lexington Ave., Pittsburgh 8, Pa.
Rockwell Spring & Axle Co., Timken-Detroit Axle Div., 100 Clark St. Detroit 32, Mich.
ROEBLING'S SONS CORP., JOHN A., SUB. OF COLORADO FUEL & IRON CORP., 640 S. Broad St., Trenton 2, N. J. P407
ROGERS BROTHERS CORP., Albion, Pa. P196
Rogers Iron Works Co., Joplin, Mo.
Rohm & Haas Co., 712 Locust St., Philadelpia, Pa.
Rollway Bearing Co., Inc., 541 Seymour St., Syracuse 4, N. Y.
Rone Cable Corp. 330 Ridge St., Rome, N. Y.
Root & Simpson, Inc., 1306 E. 17th Ave., Denver 1, Colo.
ROOTS-CONNERSVILLE BLOWER DIV., DRESSER INDUSTRIES, INC., 900 West Mount St., Connersville Ind. P151
Rose Mfg. Co., 2700 W. Barberry Place, Denver 4. Colo.
ROSS SCREEN & FEEDER CO., 100 Quimby St. Westfield, N. J. P312
Round & Son, Inc., David, P. O. Box 883, Cleveland 22, Ohio.
Ruberoid Co., 500 Fifth Ave., New York 36, N.Y.
Rust-Oleum Corp., 2425 Oakton St., Evanston, Ill.
Ruth Co., 1437 Blake St., Denver 2, Colo.
Ryerson & Son, Inc., Joseph T., 16 & Rockwell Sts., P. O. Box 8000 A, Chicago 80, Ill.

S

Safety Clothing & Equipment Co., 1990 E. 69th St., Cleveland 3, Ohio.
Safety First Supply Co., 425 Magee St., Pittsburgh 19, Pa.
Safety First Shoe Co., Inc., Holliston, Mass.
Saginaw Bearing Co., 821 South Water St., Saginaw, Mich.
St. Louis Malleable Casting Co., 7701 N. Conduit Ave., St. Louis 15, Mo.
St. Louis Screw & Bolt Co., 6900 North Broadway, St. Louis 15, Mo.
St. Regis Paper Co., 150 E. 42nd St., New York 17, N. Y.
Salem-Brosius, Inc., P. O. Box 2222, Pittsburgh 30, Pa.
Salem Tool Co., Salem, Ohio.
Samuel & Co., Inc., Frank, 2200 Philadelphia National Bank Bldg., Philadelphia 7, Pa.
Sanderson Cyclone Drill Co., E. Chestnut St., Orrville, Ohio.
Sandvik Steel Inc., Steel Belt Conveyor Dept., Fair Lawn, N. J.
Sanford-Day Iron Works, Inc., Dale Ave., P. O. Box 1511, Knoxville 9, Tenn.
Sangamo Electric Co., Springfield, Ill.
Santa Fe Tank Div., Fluor Products Co., 12000 E. Washington Blvd., Whittier, Calif.
Sauereisen Cement Co., 1242 Sharpsburg St., Pittsburgh 15, Pa.
SAUERMAN BROS., INC., 626 S. 28th Ave., Bellwood, Ill. P374
Savage Co., W. J., 912 Clinch Ave., S. W., Knoxville 2, Tenn.
Sawyer Belt Hook & Wedge Co., Inc. 16 Warren Ave., Pawtucket, R. I.
Scandinavia Belting Co., 112 Keswick Ave., Box 949, Charlotte 1, N. C.
Schaffer Poidometer Co., 2828 Smallmann St., Pittsburgh 22, Pa.
Schatz Mfg. Co., Fairview Ave., Poughkeepsie, N. Y.
Schield Bantam Co., 221 Park St., Waverly, Iowa.
Schlueter Mfg. Co., St. Louis 7, Missouri.
Schneible Co., Claude B., P. O. Box 296 RP.A., Detroit 32, Mich.
Schonrock Mfg. Co., San Angelo, Tex.
Schramm, Inc., 870 E. Virginia Ave., West Chester, Pa.
Scientific Instruments Div., Beckman Instruments Inc., 2500 Fullerton Rd., Fullerton, Calif.
Scott Aviation Corp., Lancaster, N. Y.
Scott Williams Mineral Co., 2346 S. Scottsdale Rd., Scottsdale, Ariz.
Screen Equipment Co., Inc., 1750 Walden Ave., Buffalo 25, N. Y.
Screw & Bolt Corp. of America, P. O. Box 1708, Pittsburgh 30, Pa.
Schroeder Brothers Corp., Box 72 Nichol Ave., McKees Rocks (Phg. Dist.), Pa.
Seiberling Rubber Co., Akron 9, Ohio.
Selscor Manufacturing Co., P. O. Box 1590, Tulsa, Okla.
Seismograph Service Corp., P. O. Box 1590 Tulsa 1, Okla.
Selstrom Mfg. Co., 217 So. Hicks Rd., Palatine, Ill.
SERVICE SUPPLY CORP., 20th & Erie Ave., Phila. 32, Pa. P194
(Name changed to **HOSE ACCESSORIES CO.**, too late for correction in this year's Buyer's Guide.
Shaft Constructors, Inc., P. O. Box 7695, Denver, Colo.
Shaft & Development Machines, Inc., 808 Newhouse Bldg., Salt Lake City 11, Utah.
Sharples Corp., 2300 Westmoreland St., Philadelphia 40, Pa.
SHEFFIELD DIV., ARMCO STEEL CORP., SHEFFIELD STATION, Kansas City 25, Mo. P150
Shell Oil Co., 50 W. 50th St., New York 20, N. Y.
Shepard Niles Crane & Hoist Corp., Schuyler Ave., Montour Falls, N. Y.
Sheppard Co., Inc., R. H., Hanover, Pa.
Sherwin-Williams Co., 101 Prospect Ave., N. W., Cleveland 1, Ohio.
Shrader Co., F. W., 11623 S. Broadway, Los Angeles 61, Calif.
Shriver & Co., T., 848 Hamilton St., Harrison, N. J.
Shwayder Chemical Metallurgy Corp., 684 E. Woodbridge, Detroit 26, Mich.
Sight Feed Generator Co., West Alexandria, Ohio.
Sika Chemical Corp., 33-47 Gregory Ave., Passaic, N. J.
Sikorsky Div., United Aircraft Co., East Hartford, Conn.
Silent Hoist & Crane Corp., 877—63rd St., Brooklyn 20, N. Y.
Silver Bells, Ltd., 600 16th St. Oakland, California.
Simonds Saw and Steel Co., 470 Main St., Fitchburg, Mass.
Simonds Worden White Co., Dayton 7, Ohio.
SIMPLEX WIRE & CABLE CO., 79 Sidney St., Cambridge 39, Mass. PP170-171
SIMPLICITY ENGR. CO., Durand, Mich. P159
Simplicity System Co., Riverside Drive, Chattanooga, Tenn.
Sinclair Refining Co., 600 Fifth Ave., New York, N. Y.
SKF Industries, Inc., P. O. Box 6731, Philadelphia 32, Pa.
Skinner Engine Co., 337 W. 12th St., Erie, Pa.
Skookum Co., Inc., 8504 N. Crawford St., Portland 3, Ore.
Slip-On, Inc., 401 Broadway, New York
SLY MFG. CO., W. W., P. O. Box 5939, Cleveland 1, Ohio. P362
SMIDTH & CO., F. L., 11 West 42nd St., New York 36, N. Y. P187
SMIT & CO., ANTON, 111 Eighth Ave., New York 11, N. Y. P419
SMIT & SONS, INC., J. K., Murray Hill, N. J. P342
Smith-Emery Co., 781 E. Washington Blvd., Los Angeles 21, Calif.
Smith Engineering Works, 502 East Capitol Dr., Milwaukee 12, Wis.
Smith Co., A. O., 3533 North 27th St., Milwaukee 1, Wis.
Smith & Co., Gordon, 445 College St., Bowling Green, Ky.
H. C. Smith Oil Tool Co., P. O. Box 431, Compton, Calif.
Smith Welding Equipment Corp., 2633 S. E. 4th St., Minneapolis 14, Minn.
Snap-on-Tools Corp., 8026 28 Ave., Kenosha, Wis.
Snell, Inc., Foster D., 29 W. 15th St., New York 11, N. Y.
Snow-Nabstedt Gear Corp., 251 Welton St., Hamden 7, Conn.
Snyder & Son, Inc., M. L., 1811 E. York St., Philadelphia 25, Pa.
Socony Mobil Oil Co., 26 Broadway, New York 4, N. Y.
Soiltest, Inc., 4711 W. North Ave., Chicago 39, Illinois.
Solar Aircraft Co., 220 Pacific Highway, San Diego, Calif.
Sorel Steel Foundries, Ltd., Room 504, 1405 Peel St., Marine Bldg., Montreal 2, P. Q., Canada.
Sorgel Electric Co., 838-B W. National Ave., Milwaukee 4, Wis.
South Bend Lathe Works, 419 E. Madison St., South Bend 22, Ind.
Southern Carbon Brush Co., 7—18th St., S. W., Birmingham, Ala.
Southwestern Engineering Co., 4800 Santa Fe Ave., Los Angeles 58, Calif.
Southwestern Industrial Electronics Co., P. O. Box 13058, Houston 19, Tex.
Spang & Co., 143 Etna St., Butler, Pa.
Spartan Air Services, Ltd., 2117 Carl-

Ing Ave. Ottawa, Ont., Canada.
Special Instruments Laboratory, Inc., P. O. Box 2108, 312 W. Vine Ave., Knoxville, Tenn.
Specialty Engineering Co., 3300 Frankford Ave., Philadelphia 34, Pa.
Spectrochemical Laboratories, Inc., 10-10 Wood St., Wilkinsburg, Pittsburgh, Pa.
Speer Carbon Co., St. Marys, Pa.
Spencer Chemical Co., Dwight Bldg., Kansas City 5, Mo.
Spencer Turbine Co., 486 New Park Ave., Hartford 6, Conn.
Split Ballbearing, Div., MPB, Lebanon, N. H.
SPRAGUE & HENWOOD, INC., 221 West Olive St., Scranton, Pa. PP161-162
SPRAYING SYSTEMS CO., Randolph St., Bellwood, Ill. P196
Sprengnether Instrument Co., Inc., V. F., 4567 Swan Ave., St. Louis 10, Mo.
Springfield Boiler Co., 20th & E. Capitol Ave., Springfield, Ill.
Square D Co., 6060 Rivard St., Detroit 11, Mich.
Stackpole Carbon Co., St. Marys, Pa.
Stahl Gear & Machine Co., 3901 Hamilton Ave., Cleveland 14, Ohio.
Stamler Corp., W. R., Paris, Ky.
Stanco Mfgs. & Sales, Inc., 1666 Ninth St., Santa Monica, Calif.
Standard Elec. Mfg. Co., Inc., Haddon Ave., West Berlin, N. J.
Standard Electrical Tool Co., 2490 River Rd., Cincinnati 4, Ohio.
STANDARD MACHINERY CO., 211 Bayshore Blvd., San Francisco 24, Calif. P422
Standard Metal Mfg. Co., Malinta, Ohio.
STANDARD OIL CO., OF CALIFORNIA, WESTERN OPERATIONS, INC., 225 Bush St., San Francisco 20, Calif. P29
Standard Oil Co.—Indiana, 910 S. Michigan Ave., Chicago 5, Ill.
STANDARD STEEL CORP., 5060 Boyle Ave., Los Angeles 58, Calif. P406
Standard Transformer Co., Warren, Ohio.
Stanley Co., Inc., William W., 401 Broadway, New York 13, N. Y.
Stanley Electric Tools, Div., Stanley Works, New Britain, Conn.
Staplex Co., Air Sampler Div., 777 Fifth Ave., Brooklyn 32, N.Y.
Star Brass Works, 1501 Fulford St., Kalamazoo 24F, Mich.
Star Expansion, Pleasant Hill Rd., Mountainville, N. Y.
Star Jack Co., 420 Lexington Ave., New York 17, N. Y.
Star Wire Screen & Iron Works, Inc., 2515 San Fernando Road, Los Angeles 65, Calif.
Star Drill-Keystone Co., Div. Koehring Co., 920-17th St., Beaver Falls, Pa.
STEARNS MAGNETIC PRODUCTS, 635 S. 28th St., Milwaukee 46, Wis. P384
STEARNS ROGER MFG. CO., 660 Bannock St.—P. O. Box 5370, Denver 17, Colo. P421
Steber Mfg. Co., 2700 Roosevelt Rd., Broadview, Ill.
Steel-Bilt Construction Co., Carol Ave., Bridgeville, Pa.
Steel City Electric Co., 1207 Columbus Ave., Pittsburgh 33, Pa.
Steelcraft Mfg. Co., 9017 Blue Ash Rd., Cincinnati 42, Ohio.
Steelduct Co., Republic Bldg., Youngstown 3, Ohio.
Stein, Hall & Co., Inc., 285 Madison Ave., New York 17, N. Y.
Stephens-Adamson Mfg. Co., 4 Ridgeway Ave., Aurora, Ill.
Sterling Electric Motors, Inc., 5401 Telegraph Rd., Los Angeles 22, Calif.
Sterling Grinding Wheel Co., Tiffin, Ohio.
Sterling Steel Casting Co., P. O. Box 230, East St. Louis, Ill.
STEWART-WARNER CORP., ALEMITE DIV., 1826 Diversey Parkway, Chicago 14, Ill. P373
Stimmel Winch Co., Inc., 37-24 33 St., Long Island City, N. Y.
Stockham Valves & Fittings, Birmingham, Ala.
Stokes Corp., 5500 Tabor Road, Philadelphia 20, Pennsylvania.
Stone & Webster Engineering Co., 90 Broad St., New York, N. Y.
STOODY CO., P. O. Box 901, Whittier, Calif. P393
Stop-Fire, Inc., U. S. Highway 1 at Blackhorse Lane, New Brunswick, N.J.
Stowell & Co., W. H., W. 421 Sprague Ave., Spokane 4, Wash.
Stratex Instrument Co., 3515 Sunset Blvd., Los Angeles 26, Calif.
Stratoflex, Inc.; P. O. Box 10398, Fort Worth, Tex.
STRAUB MFG. CO., 8381 Baldwin St., Oakland 21, Calif. P428
Streeter-Amet Co., Grayslake, Ill.
Stroh Process Steel Co., Marvista & Calleaues, Pittsburgh 12, Pa.
Strong, Carlisle & Hammond Co., 1392 W. 3rd St., Cleveland 13, Ohio.
Strong Steel Foundry Co., Hertel & Norris Ave., Buffalo 7, N. Y.
Stulz-Sickles Co., 929-939 Julia St., Elizabeth, N. J.
STURTEVANT MILL CO., 101 Clayton St., Boston 22, Mass. P420
Sun Oil Co., 1608 Walnut St., Philadelphia 3, Pa.
Sun Shipbuilding & Drydock Co., Chester, Pa.
Sutphen, Peter O., Box 58, Everett, Pa.
Superior-Lidgerwood-Mundy Corp., 1101 John Ave., Superior, Wis.
Sutton Steele & Steele, Inc., 1031 South Haskell St., Dallas 23, Tex.
Suverkrop Instruments, P. O. Box 436, Bakersfield, Calif.
Swaby Mfg. Co., 3818 W. Armitage Ave., Chicago 47, Ill.
Swan Rubber Co. Bucyrus, Ohio.
Swan-Finch Oil Corp., 338 Hudson St., Hackensack, N. J.
Sweet's Steel Co., 770 Sweet St., Williamsport, Pa.
Swepco Tube Corp., One Clifton Blvd., Clifton, N. J. P125
Swett Iron Works, A. L., 158 Glenwood Ave., Medina, N. Y.
Sylvania Electric Products, Inc., Chemical & Metallurgical Div., Towanda, Pa.
Synthane Corp., River Rd., Oaks, Pa.
Syntron Co., 510 Lexington, Homer City, Pa.

T

Talcott, Inc., 81 Sabin St., Providence, R. I.
Talk-A-Phone Co., 1512 South Pulaski Rd., Chicago 23, Ill.
Taller & Cooper, Inc., 75 Front St., Brooklyn, N. Y.
Taylor Chain Co. Inc., S. G., 3-141st St., Hammond, Ind.
Taylor Fibre Co., Norristown, Pa.
Taylor & Co., W. A., 7300 York Rd., Baltimore 4, Md.
Taylor-Wharton Co. Div., Harsco Corp., High Bridge, N. J.
Telluride Iron Works Co., 400 Main Ave., Durango, Colo.
Templeton, Kenly & Co., 16th & Gardner Rd., Broadview, Ill.
Tennant Sons & Co., C. OF N. Y., 100 Park Ave., New York 17, N. Y.
Tennant Sons & Co., C. OF N. Y., Sink & Float Div., 100 Park Ave., New York 17, N. Y.
Tennessee Coal & Iron Div., U. S. Steel Corp., P. O. Box 599, Fairfield, Ala.
Terry Steam Turbine Co., 874 Windsor St., Hartford, Conn.
TEXAS CO., 135 E. 42nd St., New York 17, N. Y. P425
TEXAS GULF SULPHUR CO., 75 East 45, New York, N. Y. P69
Texas Instruments, Inc., Industrial Instrumentation Div., 3609 Buffalo Speedway, Houston, Tex.
Thew Shovel Co., Lorain, Ohio.
Thiokol Chemical Corp., 780 North Clinton Ave., Trenton 7, N. Y.
Thomas & Betts Co., 36 Butler St., Elizabeth 1, N. J.
Thomas Flexible Coupling Co., Warren, Pa.
Thomas Foundries, Inc., P.O. Box 1111, Birmingham 1, Ala.
Thompson Products, Inc., Valve Div., Thompson Ramo Wooldridge Inc.
Thompson Products, Ltd., St. Catherines, Ont., Canada.
Thor Power Tool Co., Prudential Plaza, Chicago 1, Ill.
Throwaway Bit Corp., 4200 N. W. Yeon Ave., Portland 10, Ore.
Thurman Machine Co., 156 N. 5th St., Columbus, Ohio.
TIMKEN ROLLER BEARING CO., 1835 Dueber Ave., S. W., Canton 6, Ohio. PP133,FourthCover
Tipp Mfg. Co., Tipp City, Ohio.
Titan Metal Mfg. Co., Bellefonte, Pa.
Titeflex, Inc., Hendee St., Springfield 4, Mass.
Toledo Pipe Threading Machine Co., 1445 Summit Ave., Toledo 4, Ohio.
Toledo Scale, Div. Toledo Scale Corp. 1002 Telegraph Rd., Toledo 12, Ohio.
Tool Steel Gear & Pinion Co., 211 Township Ave., Cincinnati 16, Ohio.
Torrington Co., 59 Field St., Torrington, Conn.
Torrington Co., Bantam Bearings Div., 3702 West Sample St., South Bend 21, Ind.
Torsion Balance Co., Clifton, N. J.
Tour & Co., Inc., Sam 44 Trinity Pl., New York 6, N. Y.
Tracerlab, Inc., 1601 Trapelo Rd., Waltham 54, Mass.
TRACTOMOTIVE CORP., County Line Rd., Deerfield, Ill. P35
Transport Trailers, Inc., 1230—12th St. S. W., Cedar Rapids, Iowa.
Trans-Weigh Corp., Wayne, Pa.
TRAYLOR ENGINEERING & MFG. CO., Allentown, Pa. PP45-48
TREADWELL CO., M. H., 140 Cedar St., New York 6, N. Y. PP130-131
Triangle Conduit & Cable Co., Inc., Triangle & Jersey Aves., New Brunswick, N. J.
Trico Fuse Mfg. Co., 2948 N. 5th St., Milwaukee 12, Wis.
Trojan Powder Co., 17 N. 7th St., Allentown, Pa.
Trombetta Solenoid Corp., 329 N. Milwaukee St., Milwaukee 2, Wis.
Troy Engine & Machine Co., 3 Railroad Ave., Troy, Pa.
Truck Engineering Corp., 1285 W. 70th St., Cleveland 2, Ohio.
Tube Turns Div., Chemtron Corp., 224 East Broadway, Louisville 1, Ky.
Tube Turns Plastics, Inc., 2929 Magazine St., Louisville, Ky.
TURBO-MIXER DIV., GENERAL AMERICAN TRANSPORTATION CORP., 135 S. LaSalle St., Chicago 90, Ill. P145
Turner Halsey Co., 40 Worth St., New York 13, N. Y.
Tweco Products, Inc., Boston at Mosley, Wichita 1, Kan.
Twin City Iron Works, Hurley, Wis.
Twin Disc Clutch Co., Racine, Wis.
TYLER CO., W. S., 3615 Superior Ave., Cleveland 14, Ohio. P398
Tyson Bearing Co., Div. SKF Industries, Inc., Massillon, Ohio.

U

Uehling Instrument Co., 473 Getty Ave., Paterson 3, N. J.
Uhrden, Inc., Dennison, Ohio.
Ultra-Violet Products, Inc., 5114 Walnut Grove Ave., San Gabriel, Calif.
Union Asbestos & Rubber Co., 1111 West Perry St., Bloomington, Ill.
Union Carbide Chemicals Co., Union Carbide Corp., 30 East 42 St., New York 17, N. Y.
Union Chain & Mfg. Co., Sandusky, Ohio.
Union Oil Co., 45 Rockefeller Plaza, New York, N. Y.
Union Switch & Signal, Div. of Westinghouse Air Brake Co., Swissvale, Pa.
Union Wire Rope Corp., Sub. of Armco Steel Cor., 2100 Manchester Ave., Kansas City 26, Mo.
Unit Crane & Shovel Corp., 6411 W. Burnham St., Milwaukee 19, Wis.
U. S. Electrical Motors, Inc., 200 E. Slauson Ave., Los Angeles 54, Calif.
U. S. Electrical Tool Co., 3640 Llewellyn St., Cincinnati 23, Ohio.
U. S. Gauge Div., American Machine & Metals, Inc., Sellersville, Pa.
U. S. Hoffman Machinery Corp., Air Appliance Div., 103 4th Ave., New York 3, N. Y.
U. S. Pipe & Foundry Co., 3300 First Ave., North Birmingham 2, Ala.
U. S. RUBBER CO., 1230 Sixth Ave., New York 20, N. Y. PP119,331
U. S. Safety Service Co., 1535 Walnut St., Kansas City 8, Mo.
U. S. Smelting Furnace Co., East A St. & L & N Tracks, Belleville, Ill.
U. S. Smelting, Refining & Mining Co., Inc., 57 Williams St., New York, N. Y.
U. S. STEEL CORP., COLUMBIA-GENEVA STEEL DIV., 120 Montgomery St., San Francisco 6, Calif.
U. S. STEEL CORP., NATIONAL TUBE DIV., 525 Wm. Penn Place, Pittsburgh 30, Pa. PP32,358-359,397
U. S. Testing Co., Inc., 1415 Park Ave., Hoboken, N. J.
Universal Atomics Div., Universal Transistor Products Corp., 143 E. 49th St., New York 17, N. Y.
Universal Dredge Mfg. Co., 124 Wazee Market, Denver 4, Colo.
Universal Electric Sales Corp., 2557 E. 79th St., Cleveland 4, Ohio.
Universal Engineering Corp., 625 C Ave. N. W., Cedar Rapids, Iowa.
Universal Motor Co., 422 Universal Dr., Oshkosh, Wis.
Universal Road Machinery Co., Kingston, N. Y.
Universal Vibrating Screen Co., Deane Blvd. & St. Paul RR, Racine, Wis.
Utah Construction Co., Shell Bldg., San Francisco 4, Calif.
Utility Mine Equipment Co., 1010 Collingwood Rd., St. Louis 24, Mo.

V

V. V. Fittings Co., 715 Cherry St., Philadelphia, Pa.
Vale Do Rio Doce Trading Co., Inc., 63 Wall St., New York 5, N. Y.
Valvoline Oil Co., Div., Ashland Oil & Refining Co., 639 Third Ave., Freedom, Pa.
Van Gorp Mfg., Inc., Box 123, Pella, Iowa
Van Waters & Rogers, Inc., 4000—1st St., Seattle 4, Wash.
Vanadium-Alloys Steel Co., Latrobe, Pa.
Vapor Recovery Systems Co., 2820 N. Alameda St., Compton, Calif.
Varel Mfg. Co., Box 13146, Dallas, Texas.
VARIAN ASSOCIATES, 611 Hansen Way, Palo Alto, Calif. P415
Vascoloy-Ramet Corp., 800 Market St., Waukegan, Ill.
Viber Co., 726 S. Flower, Burbank, Calif.
Vickers Inc., Administrative & Engineering Center, Detroit 32, Mich.
VICTAULIC CO. OF AMERICA, Box 509, Elizabeth, N. J. P332
VICTOR EQUIPMENT CO., ALLOY ROD & METAL DIV., 13808 East Imperial Highway, Norwalk, Calif. P158
Victoreen Instrument Co., 5806 Hough Ave., Cleveland 3, Ohio.
Visking Co., Plastics Div., 6733 W. 65th St., Chicago 38, Ill.
Vitro Corp. of America, 261 Madison Ave., New York, N. Y.
Voland & Sons, Inc., P. O. Box 680, New Rochelle, N. Y.
Vulcan Electric Co., 88 Holten St., Danvers, Mass.
VULCAN IRON WORKS CO., (DENVER), 2960 S. Fox, Englewood, Colo. P193
Vulcan Iron Works, 730 S. Main St., Wilkes-Barre, Pa. P193

W

Wadsworth Electric Mfg. Co., 20 W. 11th St., Covington, Ky.
Wagner Electric Corp., 6401 Plymouth Ave., St. Louis, Mo.
Wah Chang Corp., 233 Broadway, New York 7, N. Y.
Waldron Corp., John, River Rd., New Brunswick, N. J.
Walker Brothers, Spring Mill Rd., Conshohocken, Pa.
Walter Motor Truck Co., 1001 Irving Ave., Ridgewood 27, Queens, Long Island, N. Y.
Walker & Whyte, Inc., 409 Pearl St., New York 7, N. Y.
Wall Colmonoy Corp., 19345 John R. St., Detroit 3, Mich.
Wallace & Tiernan Inc., Belleville 9, N. J.
Waltham Grinding Wheel Co., Waltham 54, Mass.
Walvoord, Inc., O. W., 30 Detroit St., Denver 6, Colo.
Walworth Co., 750 Third Ave., New York 17, N. Y.
Ward's Natural Science Establishment, Inc., P. O. Box 6712, Rochester 3, N. Y.
WARN MFG. CO., Box 6064 Riverton Branch, Seattle 88, Wash. P414
Warren-Knight Co., 136 N. 12th St., Philadelphia 7, Pa.
Warren Pumps, Inc., Warren, Mass.
Warsop Power Tools Ltd., 42 Northline Rd., Toronto 16, Ont., Canada.
Washington Iron Works, 1520—6th Ave S., Seattle 4, Wash.
Washington Machinery Co., 7329 E. Marginal Way, Seattle 8, Wash.
Watt Car & Wheel Co., Barnesville, Ohio.
Waukesha Motor Co., Waukesha, Wis.
Weatherhead Co., Fort Wayne Div., 128 W. Washington Blvd., Fort Wayne, Ind.

Webb Belting & Supply Co., 1501-07 W. 12th St., Kansas City 1, Mo.
Webb Co., Jervis B., 8957 Alpine Ave., Detroit 4, Mich.
Webb Corp., Box 549, Webb City, Mo.
Webster Mfg., Inc., Tiffin, Ohio.
WEDGE WIRE CORP., Gas St. & N. P. R. R., Wellington, Ohio P376
Weinman Pump Mfg. Co., 270 Spruce St., Columbus 8, Ohio.
Wellington Sears Co., 111 West 40th St., New York, N. Y.
Wellman Co., S. K. 200 Egbert Rd., Bedford, Ohio.
Wellman Engineering Co., McDowell Enterprise, 113 St. Clair Ave. N.E. Cleveland 14, Ohio.
WEST END CHEMICAL CO., 608 Latham Square Bldg., Oakland, Calif. P394
West Virginia Armature Co., Pine St., Bluefield, W. Va.
West Virginia Belt Repairs, Inc., P.O. Box 32, Mt. Hope, W. Va.
West Virginia Pulp & Paper Co., Multi-wall Bag Div., 230 Park Ave., New York 17, N. Y.
West Virginia Works, Connors Steel Div., H. K. Porter Co., Inc. (Delaware). P. O. Box 118, Huntington 6, W. Va.
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Western Gear Corp., 2600 E. Imperial Highway, P. O. Box 182, Lynwood, Calif.
Western Insulated Wire Co., 2425 E. 30th St., Los Angeles, Calif.
WESTERN-KNAPP ENGINEERING CO., 650 Fifth St., San Francisco 7, Calif. P91
WESTERN MACHINERY CO., 650 Fifth St., San Francisco 7, Calif. P369
WESTERN PRECIPITATION CORP., 10-16 W. 9th St., Los Angeles 15, Calif. P391
Western Radiation Laboratory, 1107 W. 24th St., Los Angeles 7, Calif.
WESTERN ROCK BIT MFG. CO., 552 W. 7th South St., Salt Lake City 1, Utah. P336
Westfalia Lunen, c/o Mining Progress, Inc., Highland Mills, N. Y.
Westinghouse Air Brake Co., 3 Gateway Center, Pittsburgh 22, Pa.
Westinghouse Air Brake Co., Ind. Products Div., Wilmerding, Pa.
WESTINGHOUSE ELECTRIC CORP., Box 868, Pittsburgh 30, Pa. PP14-15
WESTINGHOUSE ELECTRIC CORP., STURTEVANT DIV., Hyde Park, Boston 36, Mass.
Weston Instruments Div. of Daystrom, Inc., 614 Frelinghuysen Ave., Newark 12, N. J.
WHEEL TRUEING TOOL CO., 3200 W. Davison Ave., Detroit 38, Mich. ThirdCover
Wheelabrator Corp., 1202 S. Byrkit St., Mishawaka, Ind.
Wheelco Instr. Div., Barber-Colman Co., 1300 Rock St., Rockford, Ill.
Wheeler Co., Inc., 2408 Harrison St., Topeka, Kansas.
Wheeler Electronic Corp., Subsidiary Sperry Rand Corp., Waterbury, Conn.
Wheeler Mfg. Co. C. H. Lehigh & Sedgley Aves., Philadelphia 32, Pa.
Wheeling Steel Corp., 1134-1140 Market St., Wheeling, W. Va.
White Diesel Engine Div., White Motor Co., 1401 Sheridan Ave., Springfield, Ohio
White Instrument Co., David, 2051 N. 19th St., Milwaukee 5, Wis.
White Lamb Finaly, Inc., 204 Chancellor St., Philadelphia 6, Pa.
Whites Electronics, 1218 M Street, Sweet Home, Ore.
Whiting Corp., 157th St., Harvey, Ill.
Whitmore Mfg. Co., P. O. Box 1640, Station C, Cleveland 4, Ohio.
Whitney Chain Co., Subsidiary of Foote Bros. Gear & Machine Corp., 237 Hamilton St., Hartford 2, Conn.
WICKWIRE SPENCER STEEL DIV., COLORADO FUEL & IRON CORP., 575 Madison Ave., New York 22, N. Y. PP328-329
WILD HEERBRUGG INSTRUMENTS, INC., Main & Covert Sts., Port Washington, N. Y. P341
Wiley Mfg. Co., Port Deposit, Md.
Wilbur & Williams Co., Inc., 650 Pleasant St., Norwood, Mass.
Wilcox Mfg. Co., P. O. Box 217, Raleigh, W. Va.
WILFLEY & SONS, A. R., Denham Bldg., P. O. Box 2330, Denver 2, Colo. P94
Wilkerson Corp., 1601 West Girard Ave., Englewood, Colo.
Willey's Carbide Tool Co., 1340 West Vernon Highway, Detroit, Mich.
Williams & Son, E. A., 325 Washington Ave., Carlstadt, N. J.
Williams, I. B. & Sons, 51 Washington St., Dover, N. H.
Williams Patent Crusher & Pulverizer Co., 810 Montgomery St., St. Louis 6, Mo.
Willys Motors, Inc., Administration Bldg., Toledo, Ohio.
Willson Products Div., Ray-O-Vac Co., 200 Thorn St., Reading, Pa.
Wilson Rubber Co., 1200 Garfield Ave., S. W. Canton 6, Ohio.
Wincharger Corp., East Seventh & Division Strs. Sioux City, 2 Iowa.
Windeler Co., Ltd., George, 2201 Jerrold Ave., San Francisco 24, Calif.
Wing Mfg. Co., L. J., 303 Vreeland Mills Rd., Linden, N. J.
Winslow Engineering & Mfg. Co., 4069-73 Holls St., P. O. Box 8246, Oakland 8, Calif.
Winston Bros., Co., 301 Clifton Ave., Minneapolis 3, Minn.
Winter Weiss Co., 2201 Blake St., Denver 5, Colo.
Wintroath Pumps Div., Worthington Corp., 1100 S. Meridian Ave., Alhambra, Calif.
Wire Rope Corp. of America, Inc., 609 N. 2nd St., St. Joseph, Mo.
Wisconsin Motor Corp., Milwaukee 46, Wis.
Witte Engine Works, Oil Well Supply Div., U. S. Steel Corp., 1600 Oakland Ave., Kansas City 26, Mo.
Wodack Electric Tool Corp., 4627 W. Huron St., Chicago 44, Ill.
Wolf Safety Lamp Co. of America, Inc., 227 Grand Ave., Brookiyn 5, N. Y.
Wood Assaying Co., Henry E., 733 West Colfax, Denver 4, Colo.
Wood Shovel & Tool Co., Roosevelt & Clark Ave., Piqua, Ohio.
Wood's Sons Co., T. B., Chambersburg, Pa.
Worthington Corp., Worthington Ave., Harrison, N. J.
Wright Power Saw & Tool Corp., Subsidiary of Thomas Industries, 1419 Illinois Ave., Sheboygan, Wis.
Wyandotte Chemicals Corp., Michigan Alkali Div., Wyandotte, Mich.

Y

Yale & Towne Mfg. Co., Yale Materials Handling Div., 11000 Roosevelt Blvd., Philadelphia 15, Pa.
Yardney Electric Corp, 40-46 Leonard St., New York 13, N. Y.
Yarnal-Waring Co., 102 E. Mermaid Lane, Chestnut Hill, Philadelphia 18, Pa.
Yaun Mfg. Co., Inc., 2120 North Third St., P. O. Box 1508, Baton Rouge, La.
Youngstown Sheet & Tube Co., P. O. Box 900, Youngstown 1, Ohio.
YUBA CONSOLIDATED INDUSTRIES, INC., 351 California St., San Francisco 4, Calif. P141

Z

Zophar Mills, Inc., 118-26th St., Brooklyn 32, N. Y.
Zurn Mfg., J. A., Div., Zurn Industries Inc., 1955 Pittsburgh Ave., Erie, Pa.

The classified advertising in E&MJ's SEARCHLIGHT SECTION on page 423 is an excellent guide to sources of USED EQUIPMENT and other special services.

PROFESSIONAL SERVICES, including CONSULTANTS, are advertised after page 423. The experts listed can solve many of your problems.

Part 3. Advertisers' District Sales Offices. See p 429

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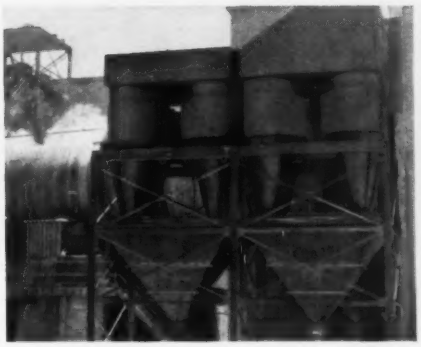
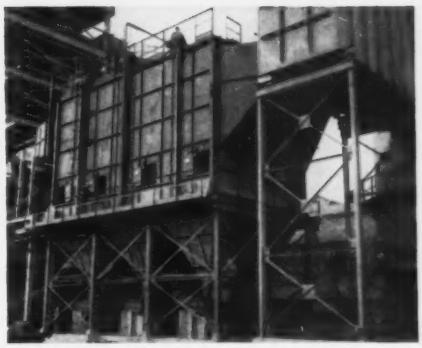
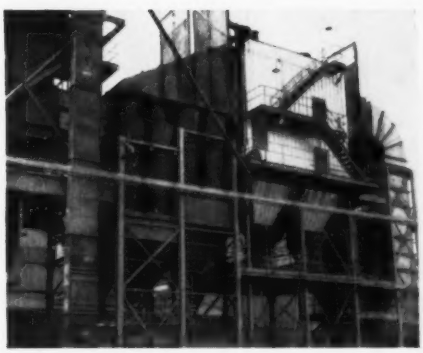


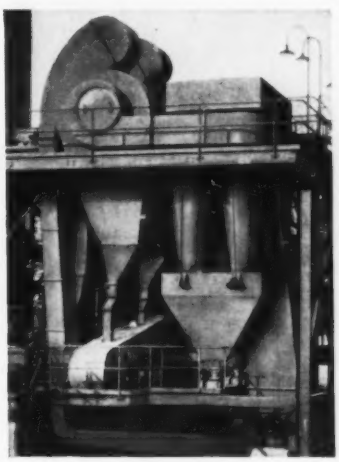
Buell Cyclone Collectors have the exclusive "Shave-off" design which utilizes double-eddy currents within the cyclones to trap an extra percentage of dust and minimize re-entrainment. Large-diameter design prevents bridging, clogging, or plugging. Extra heavy gauge construction contributes to long life. Buell-designed manifolding adds to efficiency of operation. Thoroughly described and illustrated in a booklet, "The Exclusive Buell Cyclone".



Buell 'SF' Electric Precipitators provide extra efficient recovery of dusts and lower maintenance costs year after year. The exclusive *Spiral-ectrodes* deliver 50 to 100% more electron emission than other types of emitting electrodes. Their self-tensioning characteristic minimizes electrode breakage. Buell Continuous Cycle Rapping practically eliminates "puffing". Positive Gas Flow Control through adjustable baffles assures maximum efficiency. Write for a copy of the extensively-illustrated booklet, "Buell SF Electric Precipitators".



Buell Combination Systems combine precipitators and cyclone collectors for the ultimate in profitable dust recovery. Buell Precipitators are unequalled in recovering fine dust particles, complementing the extra efficiency of Buell Cyclones. All three systems—cyclones, precipitators, and combination systems—are described in detail and thoroughly illustrated in a booklet, "The Collection and Recovery of Industrial Dusts".



Buell Classifying Systems are unique in operation, combining high efficiency with low power consumption and moderate capital investment. Patented features permit the separation of dry fine powdered or fibrous material from coarse material within a usual fine product range from 10 to 400 mesh. Systems are built in many sizes to handle from 100 pounds to 100 tons of feed product per hour without restriction on particle size or temperature. There are no moving parts. Power requirements vary from 0.04 to 0.5 fan hp per ton of feed per hour. A complete technical discussion is in a folder, "New Buell High Efficiency Classifying Systems".

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For full information on the application of Buell equipment to your plant's dust problems, write Dept. 19-F, Buell Engineering Company, Inc., 123 William St., N. Y. 38, N. Y.

Subsidiary: Ambuco Limited, Berkeley House, 15 Hay Hill, London, W.1, England.

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HEAT-TREATED, ABRASION-RESISTANT

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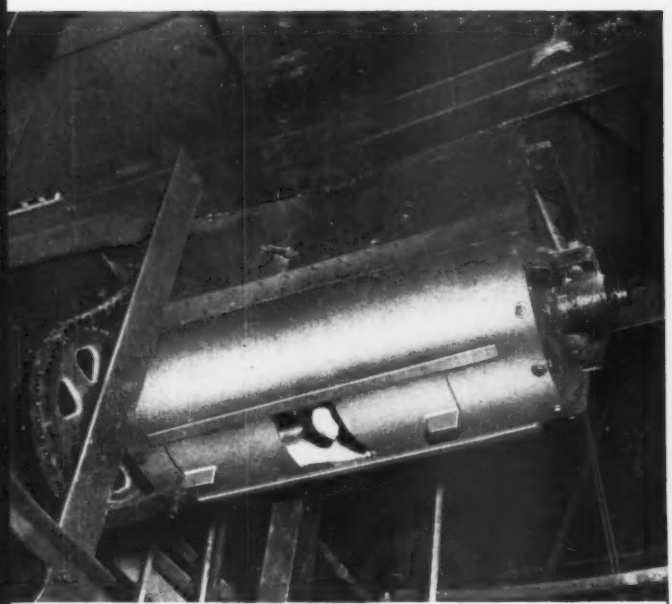
JALLOY 280 **(Brinell range 260/300)**

Has excellent low temperature impact properties. Can be bent across the width (axis of bend at right angles to direction of rolling) on a brake press or on roll forming equipment. Where forming with the axis of bend parallel to the final rolling direction, Flange Quality can be supplied on application. Recommended minimum inside radius is 2t (t = plate thickness) up to ½" inclusive in thickness and 3t over ½" in thickness.

JALLOY 320 **(Brinell range 300/340)**

Has improved abrasion resistance over Jalloy-280. Can be bent across the width (axis of bend at right angles to direction of rolling) on a brake press or on roll forming equipment. Where forming with the axis of bend parallel to the final rolling direction, Flange Quality can be supplied on application. Recommended minimum inside radius is 3t (t = plate thickness) up to ½" inclusive in thickness and 4t over ½" in thickness.



JALLOY-280

In this cement agitator bottom saves time and money in maintenance. Jalloy offers low initial cost. And, it lasts six times longer than structural carbon steel.

JALLOY-320

Is used in these round-bottom scoops for its formability and abrasion resistance, which effect savings in manufacture and operation.

The JALLOY series will best meet your requirements for:

Abrasion resistance • Atmospheric corrosion resistance
Impact resistance • Forming properties

All at minimum cost to attain proven results

HARDNESS RANGES

PLATES FOR LONGER WEAR, LESS REPAIR

representing the mean of Brinell hardness range, and by color code for easy identification.

JALLOY 360 **(Brinell range 340/380)**

Has excellent abrasion-resistant properties. For best results in welding all Jalloy ranges, a low-hydrogen AWS Spec. E 100 XX Series is recommended. Preheating and postheating are not normally required but are sometimes used in special designs to avoid concentrated stress conditions. When preheating or postheating in those cases, a range of 200/400° F. is recommended.

JALLOY 400 **(Brinell range 380/420)**

To be used for flat applications. This type has maximum abrasion resistance. All Jalloy hardness ranges are furnished only in the heat-treated condition because the chemical composition of alloy steels alone does not provide the optimum physical properties. Uniformity of strength, hardness and toughness are achieved by close temperature controls during heat treating operations.

JALLOY-360

Jalloy-360 in the bottom, and Jalloy-400 in the runners, give this dump body resistance to the impact of loading, and the abrasion of dumping aggregate materials.

JALLOY-400

Lasts three times as long as mild steel in this particular application. Aprons in these screens are subjected to severe abrasion from sliding 1-inch granite.

Jones & Laughlin Steel Corporation

PITTSBURGH, PENNSYLVANIA

STEEL

PERFORMANCE IS PROOF...

Though taking a steady pounding since 1955, San Manuel's 50 Baldwin hopper cars have needed only minimum maintenance

In the 4 years since they went into operation at the San Manuel Copper Corporation, these Baldwin hopper cars have stood up superbly under the day-in, day-out beating they must take in hauling heavy, abrasive copper ore. Regardless of the type of loading—bin, shovel or chute—Baldwin cars can be counted on for extraordinary durability and trouble-free service.

But durability does not, of course, tell the entire story. Baldwin hopper cars also embody other features conducive to profitable operation, such as:

- Air-operated bottom dump
- Dumping mechanism that automatically locks in the closed position
- Provision for dumping singly or in multiples from any predetermined car
- Roller bearing equipped axles
- 12-second dumping time for 100 tons (70 yards)

The world's largest selling side dump car —the WESTERN—is also built by B-L-H. Write us today for detailed information on both side dump and hopper cars.

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Eddystone Division

Philadelphia 42, Pa.

Hydraulic turbines • Weldments • Dump cars • Nonferrous castings • Diesel engines • Special machinery • Bending rolls • Ship propellers

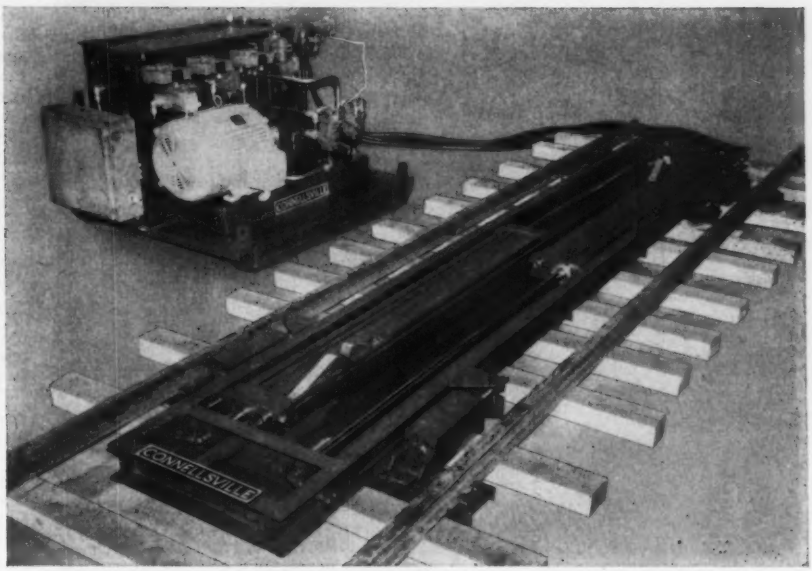
Another *Connellsville* "first"!

Model FR-10 Portable

SPRAGGER*

(INVENTION RIGHTS RESERVED)

...the retarding, reversible car spotter!



*TRADE MARK

■ Another problem solved! The new Connellsville Spragger—a hydraulic car spotter that maintains perfect control of loaded or empty mine car trips on *plus* or *minus* grades. Here's the unit that is designed to give any desired tractive effort and speed . . . it will hold any load it will push!

■ The most advanced car spotter built today, the Spragger offers these advantages—direction of feed is reversed by pushing a button, with no loss in speed or thrust . . . it has a wide, controllable range of speeds . . . easy to mount atop the track ties between rails . . . can be moved and installed, without excavation, at a new location in a minimum of time . . . plus many other cost-saving features.

For complete information, contact Connellsville Manufacturing and Mine Supply Company, Connellsville, Pa. Ask for Bulletin 300.

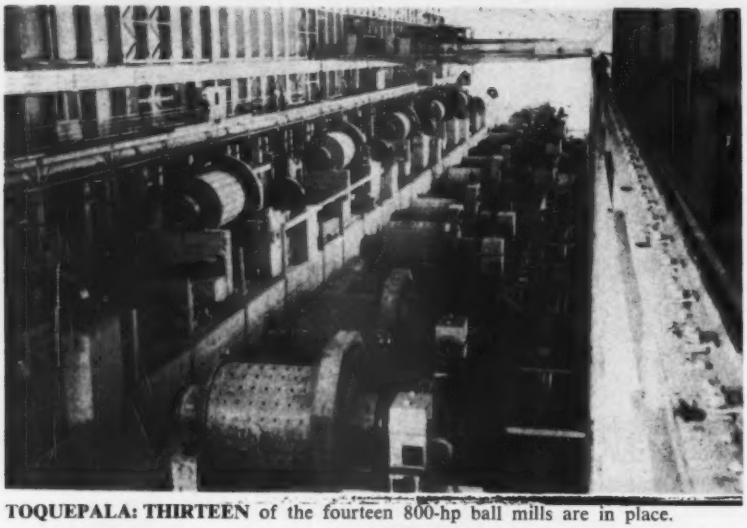
OTHER CONNELLSVILLE PRODUCTS:

Hoists (friction and winder types) · Shaft Production Equipment (Sheaves, skips, loaders, cages) · Car Handling and Dumping Equipment (Car spotters, car hauls, rotary car dumpers, etc.) · Shaft Haulage Equipment (man and material cages, automatic elevators) · Beehive and Tunnel-type Coke Equipment (coke machines, pushers, levelers, coal larries, etc.) · Other Heavy Mining Equipment

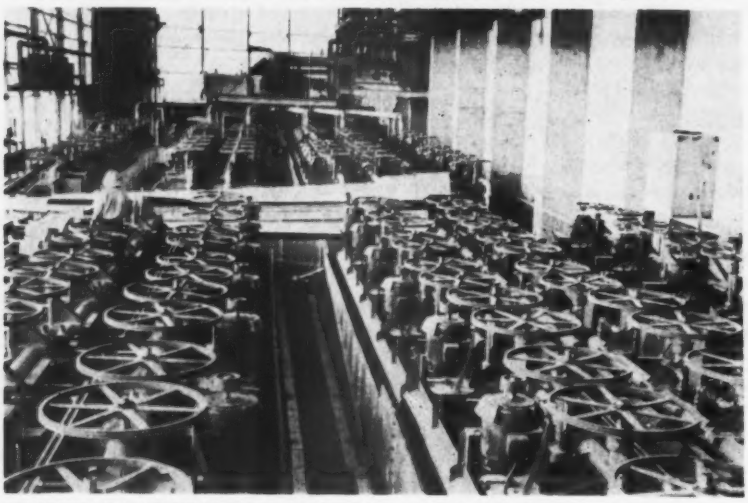
Raising Production
SINCE 1901
Connellsville MANUFACTURING

CONNELLSVILLE, PENNSYLVANIA

TOQUEPALA: THE PIT has been stripped and is ready for production.



TOQUEPALA: THIRTEEN of the fourteen 800-hp ball mills are in place.



TOQUEPALA: FLOTATION cells have been installed in the concentrator.

Toquepala Speeds Toward 1960 Target Date

WORK IS PROGRESSING rapidly on what will become one of the world's great copper mining centers in Toquepala high in the Peruvian Andes.

From the mine at Toquepala, copper ore will move to a concentrator where, after crushing, it will be ground at the rate of 30,000 tpd by fourteen 800-hp Allis-Chalmers ball mills and concentrated by flotation.

From the concentrator plant, the copper concentrate will be railroaded more than 100 miles down the Andes to a smelter 10 miles north of Ilo on the Peruvian sea coast. Here 40,000 tons of copper concentrate will be smelted monthly to blister copper. Sometime in 1960, Toquepala is expected to reach an annual production rate of 140,000 tons of blister.

Wyoming Mining Assn.

(*Continued from p 23*)

Diamond Alaki and others also are reported drilling for trona reserves in Sweetwater County, Wyo., it was learned.

Paul Blanchard, vice president of Utah Power & Light Co., Salt Lake City, said it appeared that after the next 10 years the coal industry would see a declining rate of hydroelectric production in the U.S. with a substantial increase in thermal production of electrical energy.

He foresees a large hike in role of coal in larger steam electric plants of high temperature design.

UP&L itself is planning an ultimate 500,000 kw in generation near Kemmerer, Wyo., where utility has long-term lease with Kemmerer Coal Co. covering open pit mining of a 150-foot coal seam.

Glenn E. Sorensen, president of Kemmerer Coal Co. and out-going president of the association, detailed the development of mining of ores and metals in southwestern Wyoming since establishment of the association.

Participating in a panel discussion on mapping in the state were Roy Coulson, Vitro Minerals Corp.; Dr. H. D. Thomas, Wyoming state geologist; Earl Lloyd, state engineer and J. M. Lawson, USGS. Mine and mill radiation studies were covered by Leslie Johnson, supervising engineer for the U.S. Bureau of Mines and Dr. Donald I. Walker, Washington, D. C. of the AEC.

A review of milling practice in the district was given by H. L. Hazen, consultant metallurgist while participants to the sampling panel included A. S. Runge, manager of procurement, Fremont Minerals Corp. (now called Susquehana Western Corp.); Galen Quigley, ore control engineer, Vitro Minerals Corp.; John Atkins, mining engineer, Utah Mining Co. (Utah Construction Co.); Donald Anderson, chief geologist, Lucky Mc Uranium Corp. and A. L.

A-C ALLIS-CHALMERS

metal mining modernization

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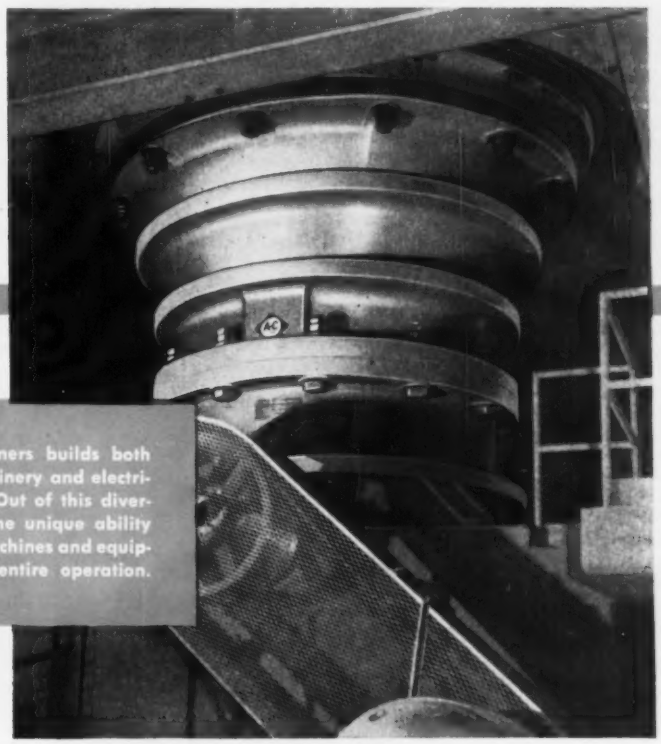
"Work Index" formula detects inefficiency... prevents misapplication

Engineers call it the Third Theory of Comminution. This "Work Index" formula offers the only scientific method of determining equipment size and horsepower requirements. Used in your modernization planning, it will detect inefficiencies in your present setup — facilitate compiling application data — indicate type and size of equipment. Ask for Bulletin 07R7995. *See your A-C representative or write Allis-Chalmers, Milwaukee 1, Wisconsin.*



Only Allis-Chalmers builds both processing machinery and electrical equipment. Out of this diversity has come the unique ability to coordinate machines and equipment for your entire operation.

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THE CHAMBER'S new building houses the staff, meeting rooms for visiting mining men, a library and an excellent mineral exhibit.

B.C. and Yukon Chamber Purchases Headquarters

"AFTER PAYING RENT" in Vancouver for 47 years, the British Columbia & Yukon Chamber of Mines has purchased the former A. E. Jukes Building at 840 West Hastings Street.

The Chamber of Mines was originally organized in the spring of 1912. The early organizers recognized that mining was destined to become one of the province's important industries, and the City of Vancouver the center of that industry. It was felt there should be, in Vancouver, a central point, or clearing-house, where prospectors and mining people could meet and discuss problems and where those having mining properties for sale could contact exploration companies.

From a small beginning of a dozen or so members, the Chamber of Mines has grown until it boasts today of a membership of no less than 1,000 individuals and companies. Included in the Chamber's membership roll are prospectors in all parts of Western Canada, also engineers, geologists, mining companies and numerous business and supply firms that deal with the industry. The Chamber receives membership support from firms in Eastern Canada, the United States, and some foreign countries. Grants are received from the City of Vancouver and the Provincial Government through the Department of Mines, to assist in financing the organization.

Many prospectors bring along samples of ore from new mineral discoveries, and these are placed on exhibit in the large showroom of the Chamber of Mines, where they are brought to the attention of exploration engineers and geologists who call regularly. Many of the prospectors and other mining people also make use of the Chamber's mining library, which contains many hundreds of copies of valuable old mining reports dealing with discoveries and developments in the early days.

Another feature of the Chamber's new premises is the private boardroom or meeting room that is available to all mining people who may be visiting Vancouver. This room is made available free of charge, and officials of the Chamber wish to encourage mining people to use it. The room will serve a useful purpose in providing a meeting-place between prospectors and exploration scouts who are searching for new deposits.

For 41 years the Chamber of Mines has conducted prospectors' training classes in Vancouver in conjunction with the Adult Education Department of the Vancouver School Board, the University of British Columbia, and the Provincial Government Department of Mines. The Chamber's officials state that during the years, over 3,500 men graduated.

Another special feature for the first time this year; the Chamber has instituted a special series of lectures in geophysical prospecting, the first of its kind in Canada. These lectures were operated in conjunction with the Physics Department of the University of British Columbia. Realizing that geophysical and geochemical prospecting will have increasing use in sections of the country that are covered with overburden, the Chamber of Mines is planning to make the lectures an annual project.

Wyoming Mining Association Meets (Continued)

Slaughter, Chief geologist, Homestake Mining Co.

NEW PRESIDENT of the association is Myron L. Sisson, of CF&I at Sunrise (left), who was congratulated by retiring president Glenn E. Sorenson, of Kemmerer Coal Co., Kemmerer.

J. W. Johnston, assistant chief engineer at Sunrise mine of Colorado Fuel & Iron Co. presented the story of "Wyoming's Pioneer Iron Mine" from which CF&I now draws more than 40% of its requirements.

A discussion of the pre-Cambrian deposits in Wyoming was given by Dr. Robert S. Houston, department of geology, University of Wyoming. Joseph S. Bailey, field representative of the Portland Cement Assn. told of the "Drama of Cement" while M. C. Long, president of the Casper Concrete Co. reported on "Sand and Gravel—A Big Business." M. J. Duzik, recently-named inspector of mines, discussed safety.

Elected president of the association was M. L. Sisson, Sunrise, superintendent of the Sunrise Mine, CF&I.

A. V. Quine, general manager of Lucky Mc Uranium and convention chairman, was elected vice president. Robert F. Love, superintendent at Green River for Intermountain Chemical, is secretary-treasurer. Mr. Quine was general convention chairman. R. W. Beamer was renamed executive secretary.

metal mining modernization

Savings by the second

Adjusting for wear is a one-man, one-minute operation on Superior crushers

Even on the largest *Superior* crushers, the time it takes to change settings is measured with a stop watch — not a calendar. The secret is *Hydroset* control. Flip a switch, it's that easy. Remarkable *Hydroset* control also facilitates emergency unloading. Remember, only Allis-Chalmers gyratory crushers offer this profit-building speed and convenience.

Bulletin 07B7870 tells the complete *Superior* crusher story. Get a copy from your A-C representative or write Allis-Chalmers, Industrial Equipment Division, Milwaukee 1, Wisconsin. In Canada, write Canadian Allis-Chalmers Ltd., Box 37, Montreal, Quebec.

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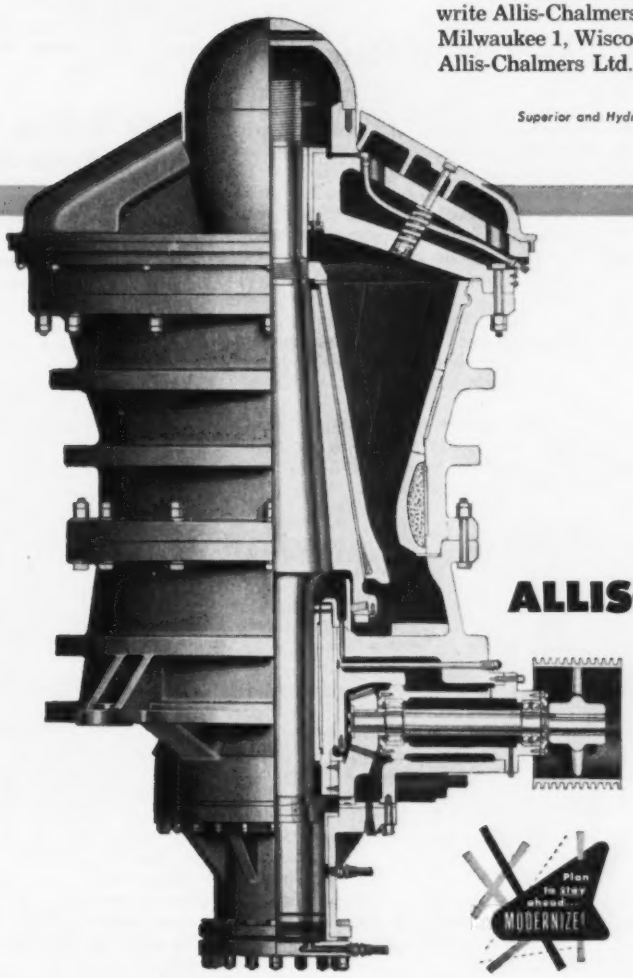


ALLIS-CHALMERS

A-5933

A BROKEN VICTOR RECORD: Plant officials note an earlier benchmark.

Phosphorus Plant's Safety Record Rewarded

IN CEREMONIES held at the Victor Plant, March 26, which were attended by most of the employes, A. P. McIntosh, chief of the Department of Industrial Safety for Florida Industrial Commission, introduced Bruce Thomas, area director for the Department, who presented E. A. Holtgrewe, superintendent of the local plant, an award in recognition of completing 2,105 days without a lost time accident. Thomas congratulated the Victor Chemical Works employees for their efforts in accomplishing such an unusual safety record, particularly a phosphorus furnace plant operation.

McIntosh stated this was the first and only certificate of its kind issued to an industry in the State of Florida, because the Victor Plant had completed a longer period time than any other plant in the history of the State of Florida. An artist prepared the award for the special event and it was signed by chairman of the Industrial Commission, James T. Vocelle.

Russell Woods, field representative of Florida Industrial Commission Safety Department, was also present.

Mr. Thomas' department has held safety courses for all supervisors in this plant which were followed up with refresher courses. Local Victor management credits these courses with much of the success in attaining its present safety record.

Victor's safety program was the subject of an E&MJ feature in November 1957, when the safety record had reached 1491 consecutive days.

AEC Announces Reserves Status of the West

NEW MEXICO and Wyoming continued to record major increases in uranium reserves as of Jan. 1, 1959, according to the Grand Junction Operations Office of AEC. However, reserves in these states may be classified, on the average, as "medium grade" under U.S. standards when compared with values in some other states, where total quantity either remained the same or decreased in 1958.

An important factor in reserve determination: prospecting for uranium by the small miner is ended in the U.S. It continues only on the part of well-heeled or integrated firms seeking "position" after Dec. 31, 1966, terminal date for Federal support of the uranium industry.

It also is believed that the reserve determinations do not fully include the multi-million ton discoveries in Wyoming's Shirley Basin area.

It is likewise essential to arrive at a figure at which AEC determines an ore to be economically amenable. The Circular Five purchase program is based on .10% U_3O_8. Yet the medium grade in U.S. reserves is well above .25% U_3O_8. On the basis of world comparisons, grade in Canada and Union of South Africa is substantially below this medium.

AEC had previously released an estimate that there were 82.5-million tons of .27% U_3O_8 ore economically minable and amenable (according to present AEC contract standards) in the U.S. as of Jan. 1, 1959.

In its state-by-state breakdown the Commission notes that reserves in New Mexico increased from 52,800,000 tons on June 30, 1958 to 54,900,000 tons by the end of the year. Reserves on Aug. 27, 1957 in New Mexico were 47.7-million; and 41-million tons on Nov. 1, 1956, when AEC first started making its domestic ore reserve estimates public.

In the latest report, AEC says Wyoming's reserves jumped from 2.4-million tons in 1956 to 11.5-million tons, with grade increasing to .31% U_3O_8.

In this same period, Utah's reserves declined from 7.5-million tons to 5.6-million tons at the end of 1958. However, Utah still has the highest grade uranium ore of any state: .35% U_3O_8.

Colorado was reported in 1956 to have reserves of 4.1-million tons; the estimate dropped in the interim to 3.3-million, but increased again to 4.3-million, largely as a result of Front Range estimates.

Rankings of major producers: New Mexico, Wyoming, Utah, Colorado.

AEC said that ore reserves in Washington, Oregon, and Nevada increased from 2- to 2.3-million tons during 1958, with grade at .24% U_3O_8. Reserves in Texas, Calif., Montana, Idaho, and Alaska now amount to 1.8-million tons of .23% U_3O_8.

Ninth Drilling Symposium Due at Penn State Oct. 8

EXPLORATION DRILLING will be the topic of a three-day symposium to be held at Penn State Oct. 8 to 10. Jointly sponsored by the Departments of Mining Engineering at the University of Minnesota, Colorado School of Mines, and Pennsylvania State University, this will be the ninth annual drilling symposium held since its inception at Minnesota in 1950.

Five technical sesssions will deal with statistics and operations research in exploration, bit design and rock penetration, improving core recovery, drilling and sampling of unconsolidated materials, and innovations and case studies in drilling practice.

The exploration drilling symposium is one of three jointly sponsored by the three schools. Colorado was host for the Rock Mechanics Symposium in April of this year and will hold the drilling and Blasting Symposium in 1960.

Record First Quarter Seen in Diamond Sales

DE BEERS has announced a record $66-million in sales for the first quarter of 1959, according to London. Gem sales were the highest ever—$44.5-million, and industrials, at $21.5-million were the best since 1952.

Should the rate continue, London predicts it would surpass 1957's record annual figure of $215-million. Much of this year's industrials were on a barter basis.

metal mining modernization

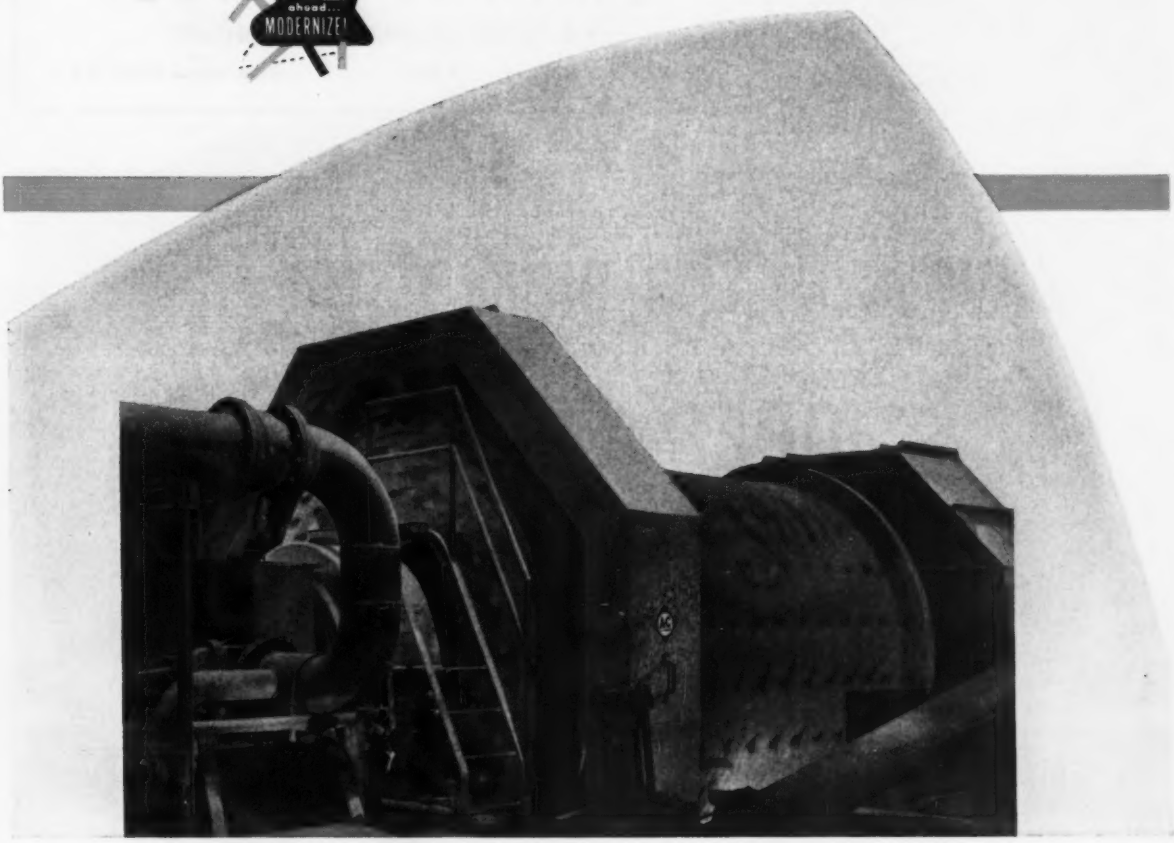
Grinding mills grow... Operating costs shrink

2000-hp mill does work of multiple units ...at far less cost

It's the big mill that grinds out profits. Want proof? In a typical installation, a giant 13 by 20-ft, 2000-hp Allis-Chalmers mill replaced two 10½ by 17 units. Operating costs were cut by a whopping 25% without losing one ounce of capacity.

Grinding mills are on the grow. The single mill conserves floor space and affords better quality control with its improved circuits. Watch for the 2500 and 3000-hp Allis-Chalmers mills soon to be announced.

Plan to stay ahead... MODERNIZE!



See your A-C representative or write Allis-Chalmers, Industrial Equipment Division, Milwaukee 1, Wisconsin. In Canada, write Canadian Allis-Chalmers Ltd., Box 37, Montreal, Quebec.

ALLIS-CHALMERS

A 5936

Hanna and Republic Drill Venezuelan Iron

M. A. HANNA MINING Co. and Republic Steel Corp. have commenced drilling and tunneling operations to evaluate iron ore deposits on concessions held in Venezuela by their jointly-owned subsidiary, Maria Luisa Ore Co.

The annual report of the Venezuelan Ministry of Mines & Hydrocarbons says work includes drilling of 6,000 meters of test holes and preparation of maps. A local drilling contractor is operating two diamond drills and a 30 year-old Bucyrus Amstrong 27-T drill, acquired from Orinoco Mining Co., on the concessions.

The Maria Luisa concessions, totaling 14,820 acres, are located approximately 50 miles southwest of Puerto Ordaz in Bolivar state, between the Orinoco River and the Cerro Bolivar working of Orinoco Mining Co. (U.S. Steel subsidiary). The Maria Luisa deposit was discovered in 1947.

Hanna also has 20,995 acres of iron ore concessions held by another Venezuelan subsidiary, Western Ore Co., near the El Pao workings of Iron Mines Co. of Venezuela (Bethlehem Steel subsidiary) in Bolivar state.

Meantime, the Venezuelan government has awarded a contract for exploratory work to determine the extent of iron deposits in a national reserve at Cerro San Isido, another iron outcrop in the vicinity of Cerro Bolivar.

IN THE U.S.

ALASKA

Mr. and Mrs. Bert Parker are planning to reopen the Mt. Parker property (formerly the LeRoy Mine) at Glacier Bay this summer, and put it into production. New milling equipment is planned. The mine is a gold quartz vein proposition, and last produced in 1950.

Equipment will be lifted up to the Billy Quitsch Little Giant gold lode above Mineral Creek near Valdez as part of a plan to put that property into production. Repair of the Mineral Creek road is being requested by the owners.

As a help to mineral industry people looking for consultants, and to consultants looking for clients, Alaska's Department of Mines will compile a list of Alaskan mineral industry consultants to be made available to those who are in the need of consulting services. ADM

ALLUVIAL DEPOSITS

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Most accurately and economically tested for . . . with the

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metal mining modernization

You can save up to 20% on close-coupled pumps

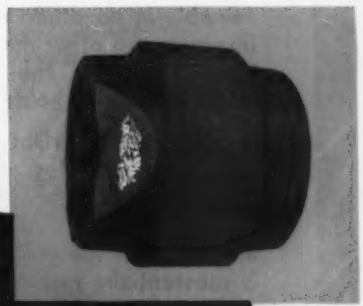
Now from Allis-Chalmers: Close-coupled pumping units powered by *Super-Seal* motors with *Poxeal* insulation!

You can save up to 20% by specifying these units. Reason: Open-type *Super-Seal* motors may be used in many areas previously requiring more costly enclosed motors.

IN ADDITION to *Super-Seal* motors, these pumping units offer heavy-duty construction, easily replaceable wearing rings, plus other quality pump features. It all adds up to an outstanding pumping package for mining installations.

CONTACT your A-C representative or distributor for coordinated pumping equipment — pumps, motors, control and drive. Or write Allis-Chalmers, General Products Division, Milwaukee 1, Wisconsin.

Capacities to 2500 gpm, heads to 550 ft.



***Poxeal* Insulation** system of *Super-Seal* motors provides a stator completely impervious to contaminating elements. Result: A close-coupled pump with an open-type motor that can "take" the toughest atmospheres.

Plan to stay ahead... MODERNIZE!

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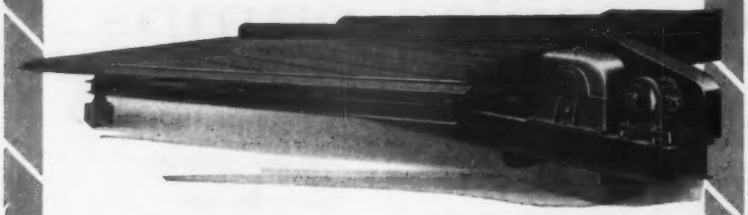
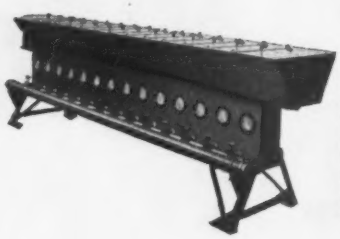
The Time-Proved Way to Concentrate Minerals Efficiently



For several decades the SuperDuty® DIAGONAL-DECK® table has offered advantages obtainable in no other way. In all those years, no invention, no other machine or process has come along to match the economic advantages its holds for you.

Only the SuperDuty table delivers such high grade concentrates at such low cost . . . with maximum recovery of values by holding tailings losses to absolute minimum. So efficient is this machine that the volume of circulating middlings is substantially reduced, thus cutting wear and tear on the re-circulating equipment and making room for more tons of new feed per day.

Join the big swing to SuperDuty tables and enjoy the extra profits they make possible. Ask for Bulletin 118-C and the abundant proof that is now a matter of record.



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Type "CPC" Classifier

This all steel Constriction Plate Classifier is available in 1 to 10 or more cells. Novel secondary classification sharpens the separations made by each main cell. Advantages offered are: (1) accurate classification or sharp sizing, (2) easy and effective hydraulic water regulation, (3) as many spigot products as there are cells, (4) continuous discharge, (5) no moving parts, (6) low maintenance cost.

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CONCENCO PRODUCTS

★ *The ORIGINAL Deister Company* ★ *Inc. 1906*

Alaska *(Continued)*

would appreciate hearing from any consultants in the mining, oil, or geophysical line who would care to be on such a list. The list would simply carry the consultant's name, address, and specialty. It will not attempt to list qualifications or experience, and being on such a list would not constitute an endorsement or recommendation by the agency.

Gov. William A. Egan has signed the new Alaska state Land Act, legislation providing regulation and control of public land in the 49th state.

The act was one of major items passed by first state Legislature, April 1959.

Enactment creates division of land within new state Department of Natural Resources and outlines procedures for leasing oil, gas, mineral, tidal and other lands within Alaska. Rules for lease of tidelands, seen as a new area of oil exploration in Alaska's infant petroleum industry, was one of major sections in the new law.

The act puts 1-million acre limitation on oil and gas lease holdings of any one company, individual or corporation in state. Limitation allows maximum 500,000 acres in leases on tide lands and another 500,000 on upland oil and gas areas.

Tidal and submerged land opened for oil and gas exploration will be on competitive bids basis, and competitive bids may be required on upland areas at discretion of the commission of natural resources or in the event the upland zone covers known oil deposits.

Tideland leases would be offered in units of 5,760 acres, and other competitive bids would be allowed in units up to 640 acres. Non-competitive leases would be offered on first-come, first-served basis under the act in units up to 2,560 acres. Producing oil royalties to Alaska from all types of leases was set at 12½%. However, initial discoveries in new structures will receive a 10-year bonus in royalty payments at only 5%.

ARIZONA

Bear Creek Mining Co., wholly-owned subsidiary of Kennecott Copper Corp., proposes purchase for between three and four million dollars of some 2,000 acres in mining claims 15 miles west of the Morenci open cut mine of Phelps Dodge Corp.

Sellers are a number of individuals from Safford and other Arizona cities. Kennecott is credited with plans for an open cut mine at the properties, 12 miles northeast of Stafford. But C. H. Burgess, president of Bear Creek at Salt Lake headquarters, said only that "no large scale developments" were contemplated in near future.

He said Bear Creek made the purchase proposal which must be followed up by formal execution of agreements and taking up of option in order to keep its hand in a "highly competitive" situation developing in Arizona copper picture.

metal mining modernization

An open motor did what no other motor could... in a mudbath

This Super-Seal motor with *Poxeal* insulation and protected bearing was not fouled by mud. An Allis-Chalmers customer, in a frequently flooded area, required a motor that could readily start even after prolonged immersion in mud.

The "dirtiest mud available" was used in conducting the successful tests in the A-C Motor Laboratories.

Motor user requirements like this form the basis for A-C pioneer-leadership in motor development. Motor buyer needs created the most complete line of integral-horsepower motors in industry. Induction, dc, wound-rotor, synchronous, gear, tube-type and *Synduction* motors, and now *Super-Seal* motors! And, if these lines don't fill your need, A-C engineering excels in special design.

Motor users in the mining industry can benefit from this pioneer-leadership. Contact your A-C representative or distributor, or write Allis-Chalmers, General Products Division, Milwaukee 1, Wis.

Super-Seal, Poxeal, and Synduction are Allis-Chalmers trademarks.

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A-1005-MM

You can't

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Use a safe wire rope...use

CF&I-WICKWIRE

This giant steelman is the Image of CF&I—and of the many steel products produced by CF&I for every type of industrial use. He represents the quality controls that CF&I exercises during every step of manufacture—from ore to finished product.

Nowhere is this exacting attention to quality more rigorously followed than in the production of Wickwire Rope. That's because a quality rope is a safe rope. It helps the user eliminate losses due to injuries or wrecked equipment that can result when a "bargain" rope fails.

Wickwire Ropes are available in a complete range of sizes, constructions and grades—including Wickwire Double Gray *extra*-improved plow steel rope for your extra high strength rope requirements.

For safety's sake, use a quality wire rope . . . buy Wickwire.

WICKWIRE ROPE

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In the West: **THE COLORADO FUEL AND IRON CORPORATION**—Albuquerque • Amarillo • Billings • Boise • Butte • Denver • El Paso Farmington (N.M.) • Fort Worth • Houston • Kansas City • Lincoln • Los Angeles • Oakland • Odessa (Tex.) • Oklahoma City • Phoenix Portland • Pueblo • Salt Lake City • San Francisco • San Leandro • Seattle • Spokane • Tulsa • Wichita

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6631

THE ONLY VALVE THAT OUTLASTS METAL

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FLEX VALVE

- Non-clogging
- Corrosion-resistant
- Full pipe capacity
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- No freeze-up in outdoor service
- No obstructions, pockets or internal parts
- Tight on grits to 1/8"
- Maintenance free

More than six years of service carrying abrasive materials that had ruined iron gate valves in four weeks — and still no signs of wear! That's the kind of record FLEX VALVE has chalked up in mining operations. FLEX VALVE's tough valve body materials have resisted the onslaught of steel shot, stone, coal ore, mine tailings, cement, other valve-destroying matter for thousands of hours of trouble-free service. Here is the simplest valve made . . . An integral part of your piping with no internal parts to stick or wear, no diaphragms or packing to leak. The original pinch-type valve — built by Farris for the mining industry's toughest service. In manual or motor-operated types.

FREE TWO VALUABLE BOOKS ON FLEX VALVES

Detailed engineering data, plus special sizing charts are in FL-1116R Flex Valve catalog; Bulletin FL-935 lists several hundred typical uses. Both books yours for the asking.

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Arizona *(Continued)*

Inspiration Consolidated Copper Co. is proceeding, according to P. D. I. Honeyman, president, "with the development and equipment of the Christmas property. Detailed engineering and design are in progress, and materials and equipment are being ordered. Contracts are under negotiation for erection of the main shaft headframe and for sinking and lining the shaft. General surface preparation has been resumed. Well drilling is nearing completion. Underground development continues. Ore is being mined for further metallurgical testing."

CALIFORNIA

Plans to "drift in on #9" have been made by the Miracle Mine Co. Their claims are situated across the Kern River from those of the Kern Uranium Co., which has sent out shipments of U_3O_8 ore over a long period of time.

A total of four carloads have been shipped from Miracle, whose operations have been hobbled by litigation. The mine is now the uncontested property of Brooks Mann, Taft tinsmith and president of the company; Joe Mann and George Killmer, also of Taft; Roy Bartlett, now in Lake County, and his son, Donald Bartlett of Salt Lake City; and Chris Musick, Bakersfield painting contractor.

Now that the mine is uncontested (and assessment time is coming around), the stockholders plan to extend the mine's #9 drift from the present six ft. The AEC reported a 0.30 U_3O_8 ore sample as coming from #9, Musick says. The four carload shipments came from #5, which now drifts in a total of 600 ft. The company's longstanding contract with the AEC is still in effect, Musick said, though he doubts that any shipments will be made in the near future.

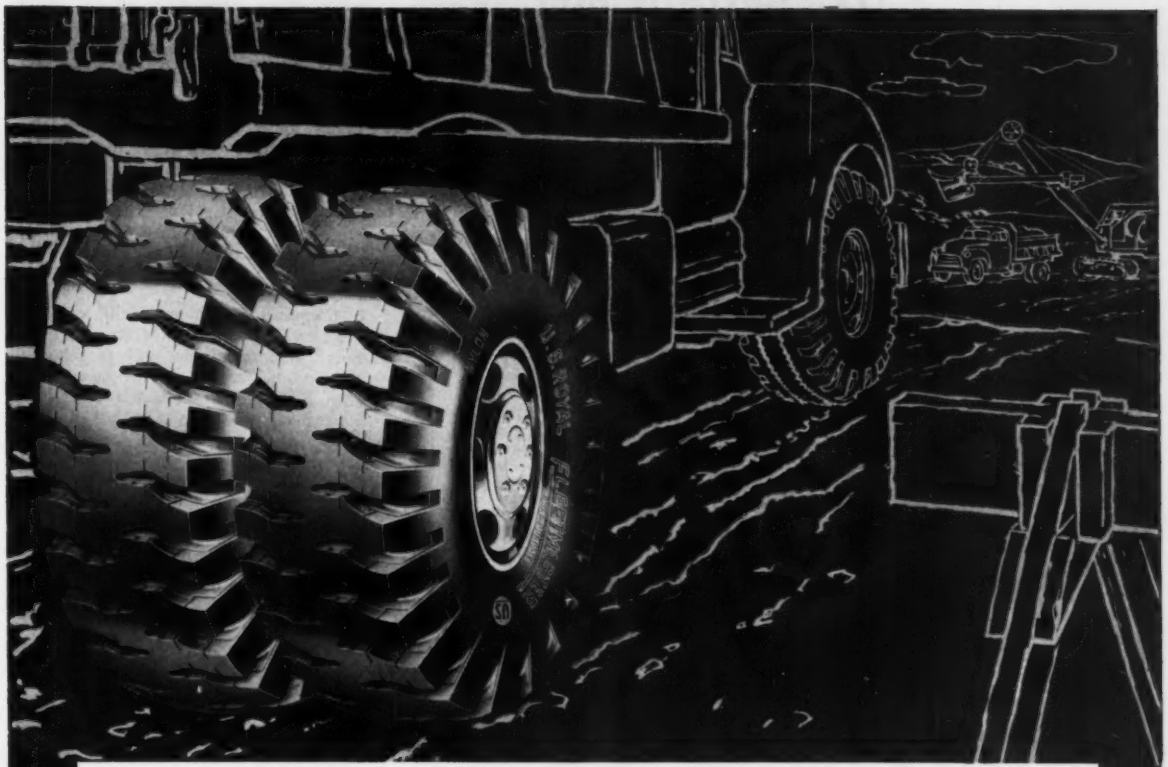
John Payer has resumed development work at uranium claims near White Ledge Peak in the Santa Ynez Mountains in the Los Padres National Forest.

Anaconda Wire and Cable Co. has agreed to purchase 100% of the stock of Sequoia Wire and Cable Co., Redwood City, from Mandrel Industries. It will operate the company as a wholly-owned subsidiary for the manufacture of small wires for use in aircraft, missiles and electronic controls.

Sonoma Quicksilver Mines, Inc., third largest domestic mercury producer, for the nine months ended March 31, 1959, reported net profit increase to $218,852. For the preceding full fiscal year ended June 30, 1958, net profit was $165,000.

The profit gain this fiscal year, Sonoma says, stemmed both from a stable price for quicksilver and a relatively high rate of output that currently is being slowed by major mine improvements that are proceeding concurrently with mining operations. S. R. Smith, president, said once the improvements are completed about the end of August, production efficiency will be "vastly improved."

NEW STRENGTH, NEW DRIVE CUT COSTLY DOWNTIME



New Cross-Lug U. S. Royal Fleetmaster Dual-Purpose-Nylon beats the tire hazards that can wreck tight schedules!

Contractors all over the country are finding out that using this great new U. S. Royal Fleetmaster Dual-Purpose reduces job delays due to tires. Its 52% stronger body, of exclusive Double-Strength Nylon cord, defies impacts that ruin ordinary tires. Its big, deep cross-lugs dig in for 35% greater traction, prevent spinning wheels, bogged-down trucks, broken schedules. See it for yourself. Call your U. S. Royal Dealer right now. And make sure to specify "U.S. Royal" on the next new equipment you buy! Available in tubed or tubeless construction.

U.S. ROYAL SAFETY 1ST TRUCK TIRES

US RUBBER **United States Rubber**

Rockefeller Center, New York 20, New York

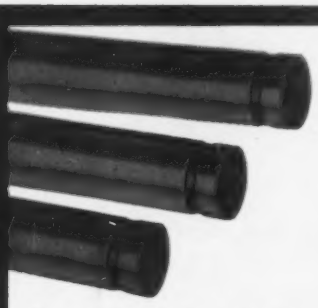
CUT COSTS WITH THE NEW

VIC-EASY®

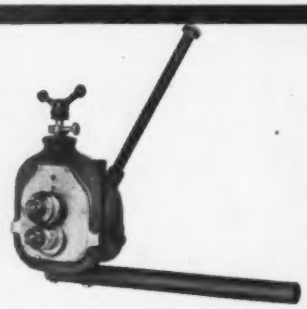
METHOD OF JOINTING LIGHTWEIGHT PIPE

SAVE UP TO 60% IN PIPING COSTS!

Now there's no need to buy overweight pipe. Thanks to Victaulic engineering, you can select lightweight pipe "job-rated" to your conditions and install it the *new VIC-EASY* way. You'll cut costs of pipe, transportation, and handling —you'll save from 30% to 60% in man-hour installation.



1. LIGHTWEIGHT PIPE in thicknesses from .065" handles high pressures. Leading mills make sizes 1¼" to 12", steel or aluminum, with *VIC-EASY roll-grooved ends.*



2. VIC-EASY PORTABLE GROOVER rolls grooves into pipe in seconds. Manually or power-operated, this groover removes no metal...retains full wall thickness.

3. VICTAULIC SNAP-JOINT COUPLING assembles and locks by hand—no wrenches or tools required. Other bolted styles of Victaulic Couplings alternately usable.

4. VICTAULIC FULL-FLOW FITTINGS team up with our couplings and lightweight pipe to provide a *complete VIC-EASY system*...cuts costs of installation *and* operation.

For complete information write for Bulletin CC-6

VICTAULIC COMPANY OF AMERICA
P.O. BOX 509 • Elizabeth, N. J.

COLORADO

John H. East, Jr. regional director of the U. S. Bureau of Mines has expressed alarm at the number of mines closed in Colorado. The state's 1958 mineral output of $300.8-million was a drop of 11% from the 1957 figure. Production reached $329.5-million in 1956.

"During the Korean War we had scores of metal mines all over the state," East said. "Today there are only a few. When prices have gone up for everything else, they've kept going down for metals."

East said the value of non-metal production increased 9% last year but "could not begin to offset a drop of 19% for metals and 11% for the fuels group."

The decrease was partly blamed on a 2½-month strike at the Climax Molybdenum mine, now settled. Molybdenum accounted for the biggest share of the value of the ores but East said there was "a substantial drop in molybdenum output."

J. Cameron Grant, president and general manager of Argyle Mining & Milling Corp. says the Pride mill at Silverton will resume milling in the near future after having been closed a short time for general repairs and to await an increase in ore shipments from mining operations at Pride of the West and Osceola.

Grant said newly broken ore was improving in mineral value and that higher grades of ore would be milled first. Other ore reserves of lower grade are being withheld from mining and milling until prices advance.

Gold receipts at the Denver Mint totaled 47,439 oz worth $1,660,394 in February. Mint officials report February receipts a year ago came to 54,533 oz valued at $1,908,651. Silver receipts were down to 553,804 oz valued at $501,204 from 1,082,729 oz worth $979,796.

A 30% drop in molybdenum sales coupled with lower prices for copper, lead and zinc during the past year have been reflected in the reduced earnings of American Metal Climax, Inc., according to its 1958 annual report.

Anticipating and hoping for favorable action by the Atomic Energy Commission on the application for a uranium mill contract, the Golden Cycle Corp., United Western Minerals Co. and Norbut Corp. have agreed to, and are carrying out, an exploration program in the Colorado Front Range area near a producing mine. Any ore located will be shipped to the Carlton uranium mill if and when completed, or, if not approved, to other mills within shipping range. "We have staked claims and have an option on several thousand acres of fee land upon which favorable geologic structures occur and have leased other fee land where the mineral rights are owned," says the Golden Cycle report. **Russ Wood, assistant general manager of Standard Uranium** has been in Sil-

Bethlehem Shaft Ropes at the O'Donnell No. 1—This headframe is at the O'Donnell No. 1 Mine, Four States, W. Va.—a high-quality steam coal operation of Rochester & Pittsburgh Coal Co., Indiana, Pa. The man-hoist rope, now in its eleventh year of service, is 1⅜ in. 6 x 27 Type H flattened strand Form-Set, improved plow steel, lang lay, fibre core. The materials-hoist rope is 1½ in. 6 x 27 Type H flattened strand Form-Set, improved plow steel, lang lay, fibre core. The cage has left-lay and right-lay hoist ropes to counteract any tendency of the cage to twist in the guide supports. The Bethlehem rope in this application is demonstrating the strength, endurance, and toughness for which it is well known.

Bethlehem Steel Company, Bethlehem, Pa. On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

Mill depots and distributors from coast to coast stock Bethlehem wire rope

BETHLEHEM STEEL

Cross section of Lawrence Heavy-Duty Lined Slurry Pump.
8-inch Lawrence Heavy-Duty Lined Slurry Pump.
LAWRENCE PUMPS INC.
SPECIAL HANDLING

for heavy abrasive slurries with solids in suspension

Where abrasive wear is unusually severe or could cause severe damage if the casing wore out, a Lawrence Lined Slurry Pump provides the answer.

The pump is built with a casing liner, disc liner and impeller made of hard, brittle, abrasion-resistant alloy such as manganese steel, Ni-hard, etc. As the casing is designed to withstand full pressure, the liner can be used until actually worn out. Renewal of both the liner and the impeller (if necessary) is very simple because the casing is split horizontally.

The impeller is made with extra large clearances to prevent clogging. Sealing connections are provided on the suction disc and on the hub to flush out any grit or solid matter to prevent wear at these points.

For complete information about Lawrence Slurry and Sludge Pumps write for Bulletin 207-4.

LAWRENCE PUMPS INC.
371 Market Street, Lawrence, Mass.

Colorado *(Continued)*

verton checking progress of the Shenandoah Ltd. operations in that section. "Plans are going ahead on schedule," said Wood.

Work at the Shenandoah mine, which will consist largely of development is shaping up fast. Caves are being picked up, timber replaced and track and equipment repaired. Wood said the mine was in better condition for operation than first thought. The work here will be largely of a development and exploratory nature until a profitable mining operation is foreseen.

Point of greatest interest right now is the Gold King tunnel. Bulldozers have been employed to remove loose rock from the old portals and solid ground has not yet been encountered. Reports reaching Silverton recently were to the effect that workmen on dozers had gotten into old timber which is indicative of proximity of the solid portal ahead.

Five Western Senators have sponsored a bill which would require the Secretary of the Interior to establish a five year program of incentive payments to domestic producers of beryl, chromite and columbium-tantalum.

Payments on beryl concentrates would be $70 per short ton for not more than 1,000 tons annually; payments could not be made on more than 150 tpy to any producer from his production in any one mining district.

On metallurgical chromite, payments would be $46 per long dry ton for the first 1,000 tons produced each year by each producer and $35 per ton for each additional ton produced up to a maximum of 5,000 tons. Payments could not be made on more than 50,000 tpy production by all producers.

Payments on columbium-tantalum concentrates would be $2.35 per lb of contained combined pentoxides, up to 50,000 lbs per year. No producer could be paid for production exceeding 10,000 lbs annually from any one mining district. Necessary appropriations would be authorized.

IDAHO

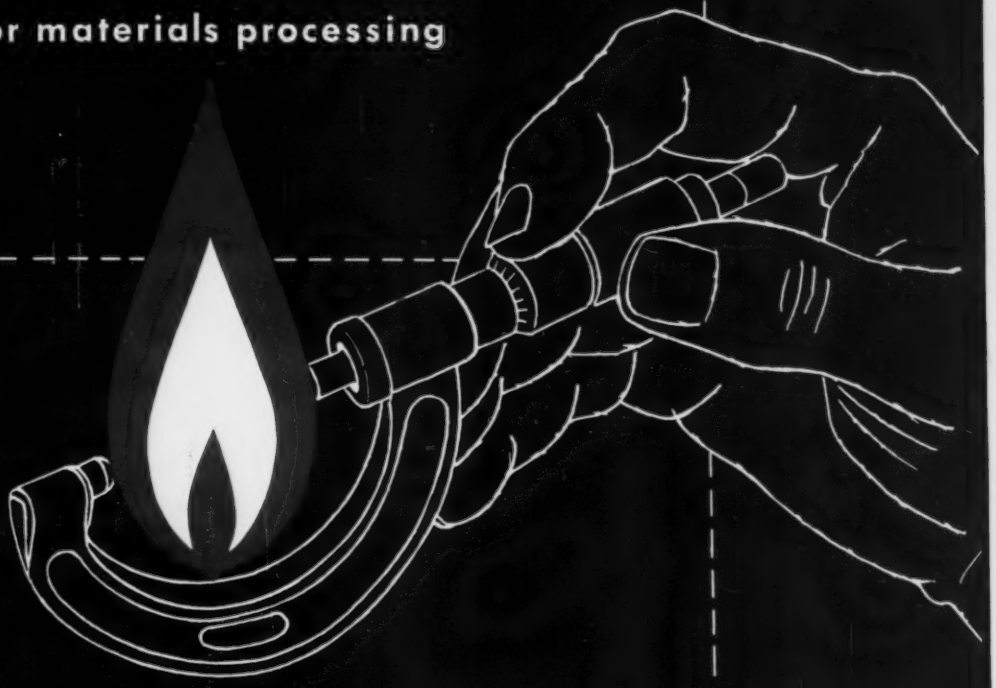
With one possible exception, economics are in favor of Kellogg for the location of the Bunker Hill Co.'s $10-million fertilizer plant, John D. Bradley, Bunker president, stated in a letter to the Wallace Chamber of Commerce. The "one possible exception," he said, has to do with gypsum which comes off as a by-product in the contemplated operation. "In Kellogg, we can rather conveniently dispose of the gypsum physically, but there appears to be little likelihood of disposing of it profitably for agricultural or other use. At another site on the Columbia River near Kennewick, Wash., we may be able to market the gypsum at a price which will outweigh the freight and operating advantages at Kellogg," he said.

D. R. Theophilus, president of the University of Idaho, announced at Moscow

precisely controlled

HEAT

for materials processing



Nichols thermal processing specialists draw on world-wide experience in the application of controlled heat for processing minerals and chemicals. Dependable, adaptable Nichols Herreshoff and Bethlehem Wedge multiple hearth furnaces are being used for such applications as:

ROASTING of ores, concentrates for manufacture of acids and for production of zinc, molybdenum, copper, nickel, cobalt, mercury, uranium, tungsten . . .

REGENERATION of filter media, activated carbon, bone char, chemicals, catalysts . . .

CARBONIZATION and activation of hydrocarbons, coal, refinery and gas plant by-products, sawdust . . .

CALCINING of non-metallic minerals such as kaolin, soda products, magnesia, limestone fines and sludge, bauxite, fullers earth, filter media . . .

DRYING of many kinds of sludge, ores, sands, concentrates . . .

NICHOLS

ENGINEERING & RESEARCH CORPORATION

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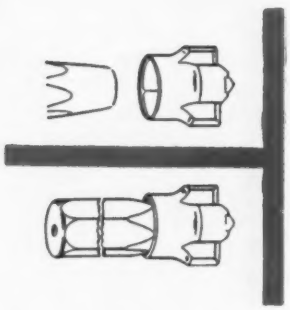
LIDDICOAT

the tungsten carbide bit that needs no resharpening

Patents applied for

Fast drilling—long life—low first cost—low cost per foot of hole drilled

The exclusive, shallow, long-life inserts need no resharpening because they do not develop a reverse taper dullness . . . a condition that stops drilling in the conventional multi-use bit. The exclusive design of LIDDICOAT permits fast drilling far beyond the point where conventional multi-use carbide bits must be withdrawn from service for resharpening. Fast drilling continues during the entire bit usage without need of resharpening.



Taper socket — No threads — Fast, firm attachment

The type TS Tee Cee Liddicoat (no resharpening) bit has a completely new, short-taper socket connection. Within the socket of the bit is a brass shim. The socket, which is completely forged, is tapered to correspond to the taper placed on the drill rod. The connection assures an absolute attachment to the rod, and yet permits easy removal.

Forged for toughness from nickle alloy steel

Bodies for Liddicoat bits are produced by forging. By a patented manufacturing process, the alloy steel is subjected to tremendous pressure which extrudes it into the desired shape. This method preserves the important grain of the steel, flow lines being compressed rather than cut across as is usual in forgings of this type. The retention of the unbroken grain and the compression of the material gives Liddicoat bits an unusually strong structure.

WESTERN
Rock Bit
Manufacturing Company

552 West 7th South Salt Lake City 1, Utah

Idaho *(Continued)*

that architects have been instructed to draw up plans and specifications for a new $500,000 mines building at the University. The mining industry of the state has raised $250,000 to match a like amount the legislature of Idaho agreed to put up for the new structure two years ago. Work will start during the summer.

Idaho Governor Robert Smylie announced in Boise that he has asked the Western Governors Mining Advisory Council to meet July 8 and 9 in Sun Valley, Idaho, to consider the serious situation facing the nonferrous and strategic metal mining industries of the western states and Alaska. The mining advisory council will make recommendations for consideration by western governors at their annual meeting Sept. 24-27 in Sun Valley, Governor Smylie said.

Some diversification of interest with the hope of offsetting the uncertainties that attend lead and zinc at the present time is under consideration by Merger Mines Corp., C. H. Hunter, president, stated at Coeur d'Alene. He said leasing of the old upper workings of the Bear Top mine near Murray with a view to seeking gold in that area is among diversification plans under consideration.

Idaho Mining and Milling Inc., of Lewiston has purchased a Yuba gold dredge formerly used in operations at Warren, and is moving the equipment to the corporation's new dredge ground in the Florence basin of Idaho, where extensive operations are planned during the summer months. Marion G. Jungert of Lewiston, secretary of Idaho Mining and Milling, is directing the dredge transfer operations.

Norman M. Smith, manager and a director of Sunshine Consolidated, Inc., told stockholders at their annual meeting in Kellogg that "nothing unusual is anticipated by the company this year." W. M. Yeaman, Yakima, Wash., company president, said the company's operations, like those of all other lead and zinc mining companies, are entirely dependent on Congressional action to bring about improvement of the metals situation.

Stockholders of National Uranium Corp. and Hypotheek Mining and Milling Co., with headquarters in Idaho, were notified by Roy H. Kingsbury, Wallace, secretary, that both companies are investigating gold properties in northern Idaho as a possible diversification of their operations.

Ira B. Joralemon of San Francisco, mining engineer and consulting geologist, stated at Spokane that the Coeur d'Alene region of Idaho is one of the deepest lead-silver mining areas in the world, probably exceeded only by mines in Burma, and he said "lots of ore remains to be found in the district."

Bulldozer trenching and shaft rehabilitation work are planned by the Sidney Mining Co. preparatory to sinking at

Lima 1250 3½-yd. Shovel nears end of million-and-a-quarter-yd. excavating job on highway reconstruction project near Knapp, Wis.

"LIMA 1250 moves half million yards of rock—at 270-300 yards hourly!"

says Lawrence Gerke, Wisconsin contractor

The job was tough, the schedule tight. "In only 2 miles," says contractor Lawrence Gerke, of Merrill, Wis., "we had to excavate a million and a quarter yd. . . . almost half of it rock!"

High performance, low maintenance

The project involved reconstruction on U. S. Interstate 94 near Knapp, Wis. Gerke needed a high performance machine with low maintenance requirements. He says, ". . . After considerable analysis of equipment, we purchased a Lima Type 1250 for rock excavating. In many cases no blasting was done. Yet, working in this material, the Lima constantly averaged 270 to 300 yd. per hour. When shovel work was completed, the 1250 was easily converted in the field to a dragline."

The crawler-mounted Type 1250 has turned in outstanding performances everywhere as a 3½-yd. shovel, 85-ton crane, and variable dragline.

Air-controlled precision

Main operating and auxiliary functions are air-controlled for smooth, precision performance at full capacity operation. Choice of diesel engine or electric motor with torque converter. Other features and available equipment include: Independent propel, extra-high-speed hoist attachment, third drum, power reversing hoist drum, two types of rigid and folding gantries. The 1250 can be knocked down to units of less than 60,000 lb. for haulage.

Whatever your job, there's a Lima type and size exactly right—½ to 6-cu. yd. shovels, cranes to 110 tons, draglines variable. Learn now why so many contractors agree with Lawrence Gerke when he says, "We are completely satisfied with the operation of our Lima." See your nearby Lima distributor or write to us.

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LIMA Construction Equipment Division, Lima, Ohio

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Shovels • Cranes • Draglines • Pullshovels • Roadpackers • Crushing, Screening and Washing Equipment

BALDWIN BLH LIMA-HAMILTON

HARBISON-WALKER REFRACTORIES

for dependable performance in every metallurgical operation

for COPPER furnaces

CHROMEX B

The desirable properties which account for the excellent service secured from this extra hard fired chrome-magnesite refractory are: high density and impermeability—relatively low thermal expansion and good resistance to thermal shock—unusual stability and strength at high temperatures. Among the important applications for this brand in copper furnaces are its use in converter linings, complete walls of refining furnaces and vulnerable positions in roofs. It is used with excellent results in linings of electric copper melting furnaces.

THERMAG

This hard burned magnesite-chrome refractory possesses the chemical and physical properties which make it particularly suited for roofs of electric furnaces used for melting copper.

H-W PERIKLASE AND H-W MAGNESITE

For the most strongly basic linings, these refractories, consisting predominantly of periclase (stabilized crystalline magnesia), fulfill the most severe requirements. They are fired at an extremely high temperature and are dense, strong and volume-stable at temperatures above the highest employed in copper furnaces. The unusually high magnesia content of these brands, together with their outstanding physical properties, account for the wide preference these brands continue to gain for use in various metallurgical furnaces.

H-W PERIKLASE possesses various enhanced properties including spalling resistance, density and lower content of accessory oxides.

METALKASE AND METALKASE XXP

Among basic refractories, H-W METALKASE brick are most resistant to severe spalling conditions. METALKASE brick are furnished in various sizes and shapes. They are made in both chemically-bonded and hard fired basic refractories of various compositions which are widely used with particular benefit in suspended roofs of smelting and refining furnaces.

METALKASE XXP are chemically-bonded basic brick formed under high pressure, with two internal plates which increase spalling resistance and reduces peeling tendency. They are available in various compositions and are furnished in standard sizes, and suspended arch and other shapes.

STAR AND VEGA

These two superior silica brick now are made at seven widely separated Harbison-Walker plants. Shipments from these advantageous locations provide important savings in transportation time and cost.

STAR brand is regarded as standard for refining furnace bottoms and roofs at many plants. It is used in reverberatory matte smelting furnace roofs and in a number of electric smelting furnaces of different designs.

VEGA is the original super-duty high temperature silica brick from which greatest benefit is derived in positions where extremely severe conditions prevail.

CALAMO 200—ANODE MOLD WASH

This alumina-silica pulverized refractory, most satisfactorily fulfills the requirement of the anode mold wash.

Other Harbison-Walker accessories for pouring molten copper include launder shapes and funnels, furnished in several classes of refractories.

for ALUMINUM furnaces

Refractories which are best suited for use in aluminum melting and holding furnaces possess properties which meet various specific requirements. In some furnaces the refractories in the bottoms are subjected to severe impact and abrasion. In the production of various alloys to meet certain rigid specifications, the refractories used must be such that any contamination, such as silicon pick-up, is avoided. High resistance to wetting and penetration by molten metal is paramount.

CORALITE 22-58 AND CORALITE 24-59

Recently perfected, these 85% alumina brick are produced in complementary compositions and both possess unusual physical properties which strongly commend them for aluminum melting furnace bottoms and walls. These brick are not wetted and penetrated by molten aluminum and are highly resistant to chemical reaction. They are exceptionally strong and withstand severe impact and abrasion.

CORALITE 22-58 is phosphate bonded while its counterpart is hard fired with a special chemical bond which contributes to its exceptional physical properties for this application.

KORUNDAL

The unusual combination of desirable physical properties of this 90% alumina refractory makes it particularly adapted for use in bottoms and lower side walls. KORUNDAL is very strong and resistant to mechanical abuse, wetting by molten aluminum and to thermal spalling. This brand, made in the modification of KORUNDAL DOT, serves various specific needs to greatest advantage.

H-W SILICON CARBIDE

Some of the most important physical properties of this refractory are measurably enhanced by developments in manufacturing procedures. Many sizes and shapes are formed by impact under pressure which accounts for increased density and strength. High temperature firing in a closely-controlled atmosphere contributes to the formation of an exceedingly impervious surface and lower permeability. It is unusually resistant to oxidation and to wetting by molten metals and can be used in various furnace positions.

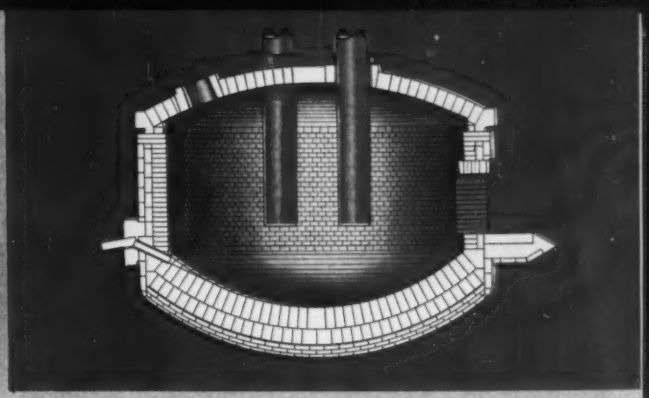
ALAMO

Along with other Harbison-Walker super-duty fireclay brick brands, ALAMO is favored for upper walls and roofs. Harbison-Walker products for aluminum furnaces comprise several other brands of high-alumina and high duty fireclay brick possessing the particular properties needed for best performance in this service.

BONDING MORTARS

CORALBOND is a unique phosphate bonded 85% alumina mortar developed specifically for use in aluminum melting furnaces. It is exceedingly resistant to penetration of the molten metal, and in the joints between the high-alumina brick it adds tremendously to the strength of the structure.

HARWACO BOND (diaspore base), THERMOLITH (chrome base) and KORUNDAL BONDING MORTAR (stabilized alumina base), cold-setting high temperature bonding mortars have unusually high strength for the temperature range of their use. While these may be used interchangeably for laying the various types of brick, each provides special benefits for particular applications.



Cross-section of Electric Melting Furnace lined with Harbison Walker Refractories.

H-W MONOLITHIC MATERIALS

KORUNDAL RAMMING MIXTURE . . . HARCHROME (H-W CHROME CASTABLE) . . . H-W EXTRA STRENGTH CASTABLE and H-W PLASTIC FIRE BRICK among the full complement of Harbison-Walker monolithic refractories are especially adapted for aluminum furnace requirements. They are favored in this industry because of the pronounced properties of volume stability, low thermal expansion and high resistance to both penetration and abrasion.

for OTHER NON-FERROUS furnaces

The service conditions in furnaces employed in the numerous non-ferrous metallurgical processes vary widely, and the refractories must meet highly specialized requirements. The selection of the proper refractory frequently governs the degree of success of the processes employed in the reduction, refining and melting of these metals. Harbison-Walker products comprise all the different types and classes of refractories needed for all the metallurgical processes, such as for the reduction and refining of nickel, lead, zinc, tin and other metals.

Extensive research and experience govern the selection of the particular Harbison-Walker refractories which serve best in metal chloride furnaces such as those used for making titanium and zirconium chlorides and for the production of metallic sodium and magnesium. Brands generally favored for these requirements are VARNON BF, H-W MULLITE and DURO.

SOME OTHER H-W BASIC REFRACTORIES

The superior performance of Harbison-Walker basic refractories is the result of a thorough knowledge of the requirements, extensive and continuous original research conducted by the Harbison-Walker Research Department, and highest quality raw materials processed in modern plants under close laboratory control.

CHROMEX

—a chemically-bonded chrome-magnesite brick having excellent spalling resistance.

MAGNEX

—a chemically-bonded magnesite-chrome brick—highly basic and of low spalling tendency.

H-W CHROME

—a hard burned chrome brick especially adapted for various specific uses.

FORSTERITE L

—the only commercially produced magnesium-silicate brick—used in roofs of metallurgical furnaces and in checker settings of open hearth steel furnace regenerators.

OTHER MONOLITH-FORMING REFRACTORIES—

Ramming Mixtures . . . H-W C-MIX (high purity seawater periclase for contour rammed basic bottoms) . . . H-W MAGNAMIX (especially suited for patching large holes) . . . Dry and Plastic Thermolith Batch (Plastic Chrome Ore) . . . Castables (all classes) . . . Plastic Fire Brick (all classes).

These refractories used in the particular applications for which they are especially suited, provide complete monolithic furnace bottoms, induction furnace linings and for copper converter tuyere zone maintenance as well as numerous other joint-free constructions.

Harbison-Walker's Technical Assistance is freely offered for the Selection and Application of Refractories that will serve dependably and economically

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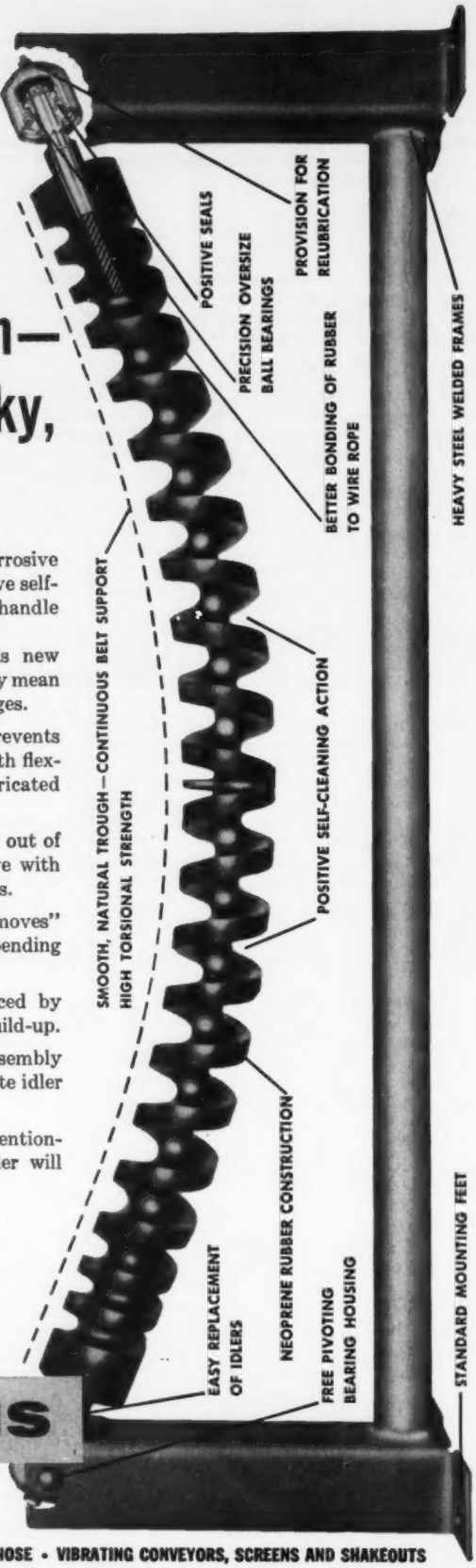
New Rubber Spiral Idler Defies Corrosion, Abrasion—Prevents Build-up of Sticky, Hard-to-Handle Materials

Here's the conveyor idler built to last longest in punishing corrosive atmosphere or extreme abrasive service! What's more, its exclusive self-cleaning rubber spiral prevents build-up of sticky, hard-to-handle materials!

The numerous design and construction advantages of this new Hewitt-Robins idler are shown in the illustration. Here's what they mean to you in terms of cost-cutting, time-saving, operating advantages.

- **LONG LIFE.** Neoprene spiral, completely covering wire rope, prevents attack in corrosive atmosphere. Uninterrupted spiral gives smooth flexing, maximum strength. Precision sealed bearings can be relubricated for still longer life.
- **SELF CLEANING.** As the spiral turns, it "works" any material out of the grooves as they change shape. This action is most effective with sticky materials which tend to build up on common types of idlers.
- **CONTINUOUS BELT SUPPORT.** The new rubber spiral design "moves" along the entire width of the belt; therefore, pinching and sharp bending of the belt are eliminated.
- **SELF TRAINING.** Belt training problems are greatly reduced by readily conforming rubber spiral, and by elimination of material build-up.
- **EASY REPLACEMENT.** The spiral, wire rope, and bearing assembly simply lifts out of its brackets—no tools are needed. The complete idler fits standard conveyor stringers.
- **TRUE OPERATING ECONOMY.** Under conditions where conventional idlers fail prematurely, the Hewitt-Robins rubber spiral idler will pay for itself many times over.

Deliveries of this revolutionary new idler are now being made in 18, 24, 30, and 36 inch belt sizes. For further information check your H-R distributor, or write Hewitt-Robins, Stamford, Connecticut. Ask for Bulletin 6-16.



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Idaho *(Continued)*

the Happy Day gold property of the company near Hailey, in southern Idaho. The Sidney Company has also entered into a joint venture with Umont Mining Inc. of Salt Lake City, for long-range exploration of 41 patented and 121 unpatented claims in the Bayshore district of southern Idaho. Malcolm C. Brown of Kellogg, president, stated in a report to Sidney stockholders that directors are "looking forward enthusiastically to a period of growth and expansion."

Clayton Silver Mines will continue operations at the company property near Clayton, in southern Idaho, for the present at least in the hope that Congressional action will bring about an improvement in metal conditions, W. M. Yeaman, Yakima, Wash, stated at Wallace. He said the company is losing money under present conditions but that these losses are less than they would be were the company to suspend and be forced to pay water pumping costs at the property.

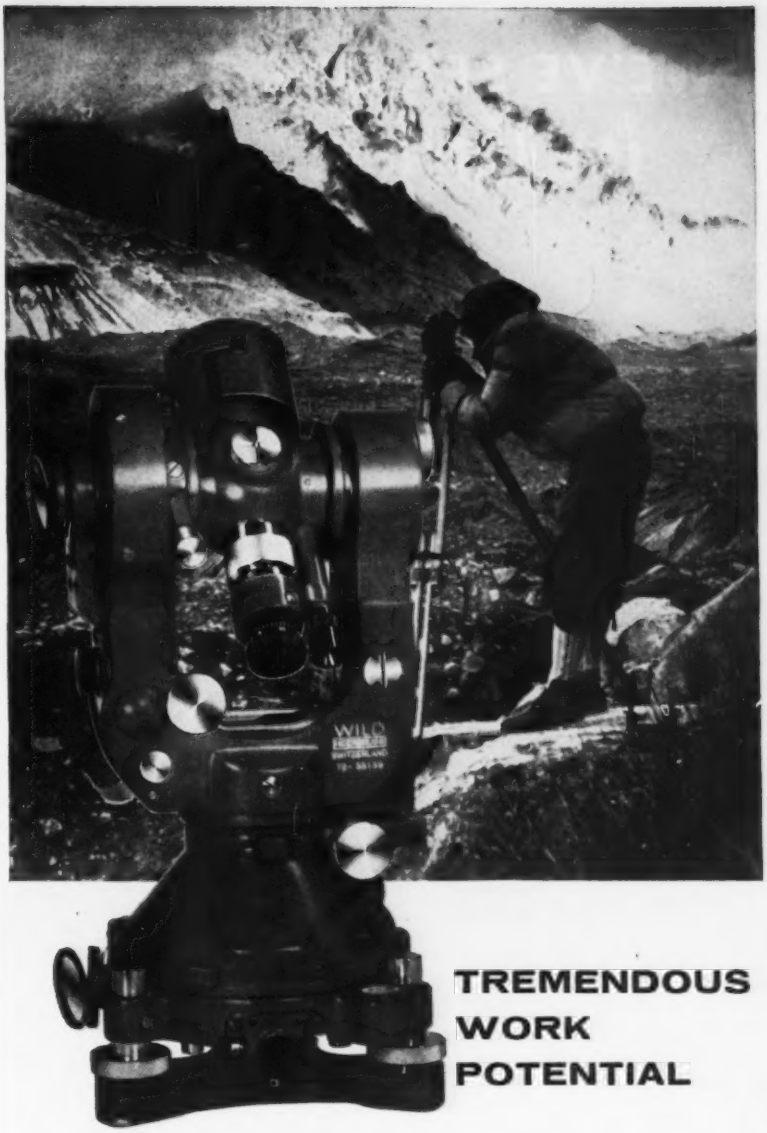
First quarter of 1959 earnings of the Hecla Mining Co. were $250,000 after deducting all charges, Hecla Mining stockholders were advised by president L. J. Randall. At the company's annual meeting in Spokane five directors were reelected and two new directors—H. J. Hull, Wallace attorney, and Ross D. Leisk, Spokane consulting engineer, were added to the board. They replace Charles Tilford, Spokane, and Joseph L. McCarthy, Orofino, a son of the late James F. McCarthy, for many years president of Hecla.

Stockholders of Silver Bowl, Inc., of Kellogg were advised by company officials that the Bunker Hill Co. has spent nearly $250,000 to date under its working agreement with Silver Bowl in exploring the Senator Stewart mine holdings of Silver Bowl, adjacent to Bunker Hill. This is only a fractional part of the work to be done to prove out the Stewart property, officials said.

Operations of the Page mine of the American Smelting and Refining Co. in the Coeur d'Alenes of Idaho were curtailed to four days May 1 because of the depressed lead-zinc prices. J. C. Kieffer, general manager of Asarco's northwest mining operations, announced the curtailment, which covers about 265 men at the Page.

The year 1958 was "both exciting and fruitful" for the Silver Dollar Mining Co., E. E. Johnston, Spokane, president, stated in a letter to stockholders which advised them of company earnings of $22,268 for 1958 after a write-off of $71,524 for abandonment of uranium operations in the Utah-Colorado area.

Anaconda, which pioneered mining and processing of phosphate rock from the Tri-State area of Utah, Idaho, and Wyoming, has signed a long term contract with Fertilizer Division of J. R. Simplot Co. whereby Simplot will manage phosphate mines and beneficiating plant at Conda.



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Idaho *(Continued)*

In 1958 some 200,000 tons of rock were produced at Conda.

According to E. S. Tierney, assistant to Anaconda vice president of Western operations at Butte, the copper firm will continue to receive phosphate rock from Conda for conversion into treble super at Anaconda, Mont.

Simplot, on the other hand, will be acquiring a new phosphate source—part of an expansion phase of the firm's fertilizer division at Pocatello. The expansion reportedly includes construction of a 200 tpd contact sulphuric acid plant at Pocatello, for use in production of treble super.

Tierney said the production of rock would be increased under Simplot management at Conda. Output has been on the decline in recent years. Anaconda opened the property in the 1920's as an underground mine, and later expanded to open pit operations. Two years ago, output was cut back.

Employees at Conda will either join the Simplot organization or be assigned elsewhere by Anaconda, Tierney said.

ILLINOIS

The first shipload of gypsum ore from National Gypsum Co.'s massive new northern Michigan mining development arrived at the company's new plant at Waukegan in early May.

Docking of the ship constituted the first link-up of parts of National's new $25-million Great Lakes gypsum mining and manufacturing network.

National mines the mineral at its open pit mine near Tawas City, Mich. The rock is crushed and carried by rail to Lake Huron where it is loaded into ships and transported to Waukegan and, later, to Lorain, Ohio where another plant is under construction.

MICHIGAN

M. A. Hanna Co.'s new beneficiation plant near Randville started production and shipment of 65% powdered iron ore concentrate with gradual increases in production expected to reach 2,000 tpd by September.

First shipment was made to Granite City Steel Co., Granite City, Ill.

About 150 men are currently employed at the mine and plant according to E. W. Geist, general manager, open pit mining, Michigan district, for Hanna Co. When full operation is reached, about 180 men will be employed on a three-shift around-the-clock basis. The plant will operate 358 days of the year.

The Hanna operation near Randville is the third iron ore beneficiation plant to be established in the Upper Peninsula. The other two are Republic and Negaunee.

Construction of the sprawling Hanna project started after Labor Day in 1957. Figures on the total cost of construction

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Michigan *(Continued)*

have not been disclosed. However, it is the largest construction job in Dickinson County since the early 1920's.

The Hanna project consists of primary crusher, secondary crusher, main concentration plant, main office and service building and garage and warehouse.

A new area which the Hanna Co. will mine covers 3,000 acres near the plant. It will be an open pit operation with an estimated ore reserve of 100-million tons. The ore will be mined in place, depending on the extent of the orebodies, to a depth of 500 ft.

MINNESOTA

President R. T. Elstad, Duluth, of Oliver Iron Mining Division, anticipates a busy season for 1959 with shipments above those for 1958. The Soudan and Pioneer underground mines on the Vermillion range will continue operating. Both are old mines with a high grade product. The Soudan was opened in 1884, has shipped a total of over 15¼-million tons and has about 1½-million tons remaining. The Pioneer, opened in 1888, has shipped about 35-million tons with around 6-million tons left in the mine. Other properties to be operated this season are the Rouchleau group at Virginia; and the Stephens at Aurora on the eastern Mesabi; the Sherman group and the Monroe near Chisholm; the Sharon at Buhl; the Arcturus at Taconite and the Plummer and King at Coleraine —all in the new western district. The Pilotac taconite operation will also continue operating at Mt. Iron. About 6,000 men will be employed.

First loaded ore boat to leave Silver Bay (Reserve Mining Co.) for the 1959 season was the *Edmund E. Fitzgerald*, largest ore carrier on the Great Lakes. The *Fitzgerald*, operated by Columbia Transportation Div., Oglebay Norton Co., took on 18,998 tons of taconite pellets April 20. The *Reserve* and *Armco* were loaded soon after. Reserve has 2-million tons of pellets in stockpile, accumulated during the winter months.

At Taconite Harbor (Erie Mining Co.) the *Sparrows Point*, Bethlehem Transportation Corp., also was loaded April 20 with about 17,000 tons of pellets.

Inland Steel Co's *L. E. Block* was loaded at the Allouez docks of the Great Northern R.R., during the night of April 20.

The Zenith Mining Co. has rejected a request of the St. Louis County Board that it lower the physical standards required of new employes. Richard Archibald, executive vice-president of North Range Mining Co. which, with the W. S. Moore Co. of Duluth, organized the Zenith Mining Co., replied to the board's letter. He said the rejections were for economic reasons. Chief causes were lame backs, pre-existing injuries, arthritis, high blood pressure and heart dis-

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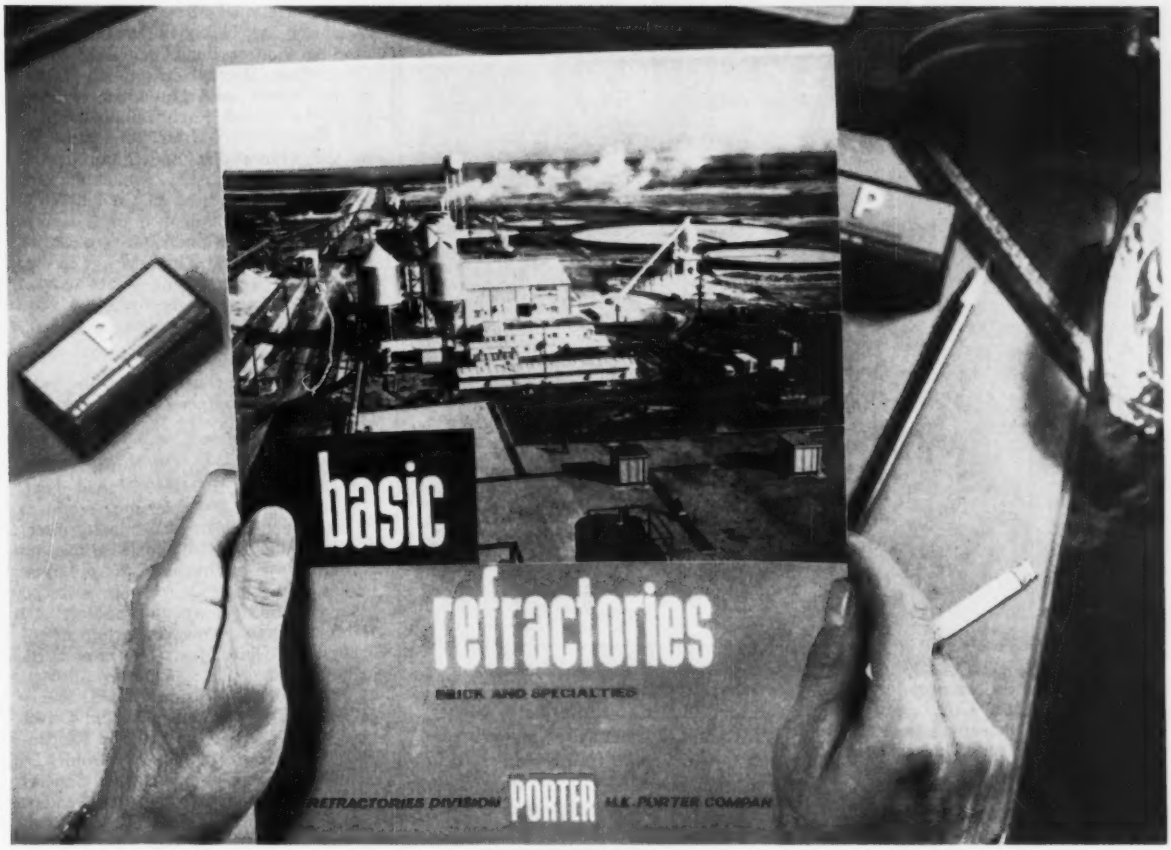

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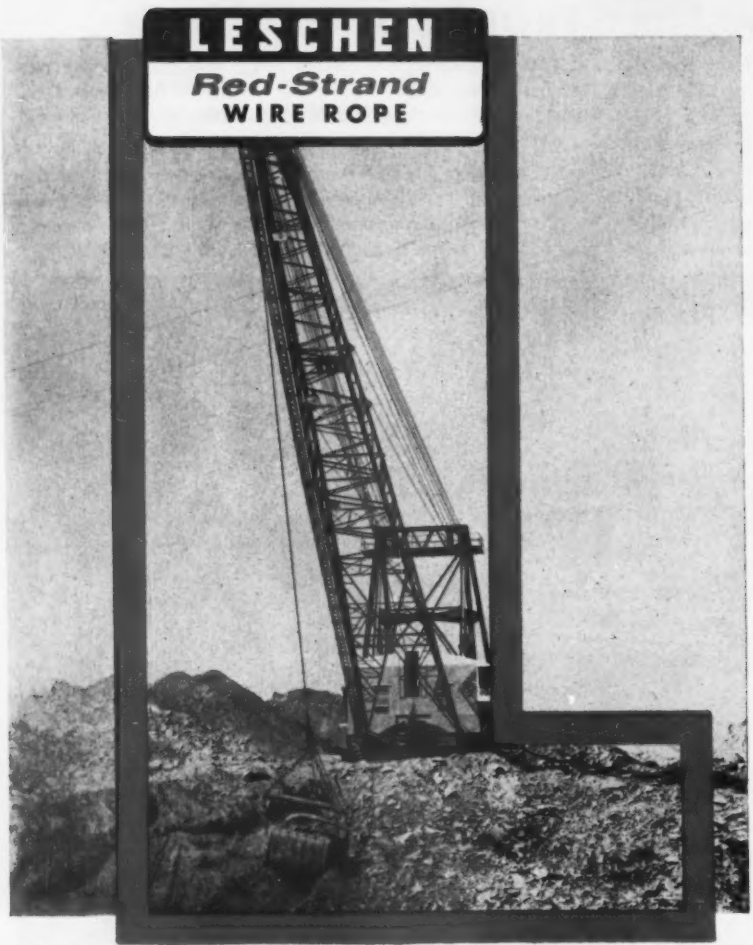

When the bite is on the dragline, you'll be glad you rigged with *Leschen*—the wire rope that's the same top quality in every foot of every reel. The new Leschen wire mill is designed to deliver exactly that. New machines . . . new processes . . . exclusive new continuous-flow technique—all as modern as tomorrow. Try Leschen Red-Strand Wire Rope now and see how its uniform quality makes your operation safer, your replacement time farther in the future. Make your next order Leschen! *Leschen Wire Rope Division, H. K. Porter Company, Inc., St. Louis 12, Mo.*

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Minnesota (*Continued*)

ease. Mr. Archibald said that preference would be given former Zenith employes and other Ely area residents who could pass the physical tests.

In 1954, Iron Ore Company of Canada shipped 1,781,453 tons of iron ore in 166 ore boats, an average of 10,732 tons per boat load. In 1955, 7,721,694 tons were loaded in 652 vessels, averaging 11,843 tons per load. The 1957 shipments of 12,352,800 tons required 716 vessels, or an average of 17,252 tons per vessel. As smaller boats are replaced with new and larger ones, the average will go still higher.

Picklands, Mather & Co. is shipping from the Rabbitt Lake open pit mine at Crosby on the Cuyuna range, which was idle in 1958.

Iron Country Mines Win National Safety Contest

INCLUDED AMONG THE WINNERS of the annual National Safety Competition, conducted by U. S. Bureau of Mines, are the Pioneer mine, of U. S. Steel's Oliver Iron Mining Co., at Ely Minn., in the metal underground mine category; the Grand Rapids mine of Bestwall Gypsum Co., Grand Rapids, Mich., in the nonmetallic underground mine group; and the Erie Commercial mine of Pickands Mather & Co. at Hoyt Lakes, Minn. in the open pit category.

Each of the winners, also including two coal mines and a quarry, will receive the bronze "Sentinels of Safety" award for first place winners, awarded each year by the *Explosives Engineer* magazine.

The 35th annual conference of the Lake Superior Mines Safety Council was held in Duluth on May 21-22. The morning meeting on the 21st was opened by H. D. Stott, director of industrial and public relations for the Calumet Division of Calumet & Hecla, Inc., president of the Council. S. B. Slade, safety director for Jones & Laughlin's Minnesota Ore Div., was in charge of the program. Papers given on the first day included "Management's Viewpont of Safety" by H. Y. Barrett, Chicago, president of Calumet & Hecla, Inc.; "Review of Injuries in the Lake Superior district, 1958," by R. F. Wilson, Duluth, manager of safety and compensation, Oliver Iron Mining Div.; "Defining the Responsibility for Safety" by Dr. John D. Grimaldi, New York, of the General Electric Co.; "High Voltage Demonstration" by T. A. Findley, St. Paul, safety director, Minnesota Electric Coop.; "Open Pit Plant Safety" by W. F. McDermott, Hibbing, metallurgist, research laboratory, Pickands, Mather & Co.; and "Materials Handling," Walter G. Kuta, Pittsburgh, safety engineer with American Steel & Wire Div.

At the evening banquet, held on the 21st, G. T. Murphy, Calumet, Mich., president-manager of the Upper Penin-

sula Development Bureau, was toastmaster. The speaker was Robert F. Forte, Milwaukee, of the Miller Brewing Co.

First paper at the morning session on the 22 was given by Richard C. Annear, Ishpeming, Mich., superintendent of Inland Steel Company's Morris mine on "Long Hole Raising". Dr. John D. Grimaldi, New York, of the General Electric Co., gave a second paper on "Our Unsafe Mines". Last for the meeting was a demonstration by a representative of the Smith Welding Co. "Safety Aspects of Oxygen and Acetylene Welding".

The Bradley open pit mine at Iron Mountain has been closed. The mine, which produced a high silica ore, was operated by Edward C. Bradley & Sons for the Jackson Iron & Steel Co., Jackson, Ohio. Mr. Bradley died last year. The mine was operated for twenty years with total production for the last 11 years of 313,941 tons. The mine equipment has been sold.

Republic Steel Corp.'s Tobin mine at Crystal Falls, which was closed last October, took on about 35 men in March and a few more in April. Repair work and some underground development work are being carried on.

Jones & Laughlin Steel Corp., from its Minnesota mines, shipped 1,897,856 tons in 1958. The Hill-Annex mine at Calumet, with 538,560 tons from the mine plant and 132,230 tons from the tailings pond reclamation plant, was first. The Columbia at Virginia was second. Other producers were: The Mesabi Mountain at Virginia, the Longyear at Hibbing and the Schley and Pettit at Gilbert.

Over 100 safety men from the Lake Superior area met at Caspian on April 2. Main subject for discussion was "Safety in Scraping Subs". The panel consisted of Fred Borgeson, Inland Steel Co.; Art Martini, Pickands, Mather & Co.; Joe Bociek and Walter Lundwall of the M. A. Hanna Co. and F. G. Michels, Ishpeming, director of safety for the North Range Mining Co., as moderator.

NEVADA

Apex Minerals Corp., which operates the uranium mine west of Austin, shipped five cars of ore to Vitro Uranium Corp. mill at Salt Lake City during the first week of April and netted $73 per ton in addition to $2,492 for haulage. The shipment consisted of 340 tons, and ore averaged from .65 to .91%.

Shipments were made from a winze about 82 ft vertically below adit A where there is shown a width of 52 ft proven by a drift of 135 ft along the orebody. Shipments from the same orebody are expected to continue for some time.

Dredging operation at Round Mountain were resumed April 13 by Round Mountain Gold Dredging Corp., and a full

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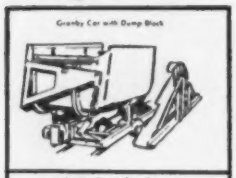

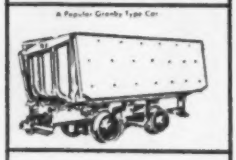

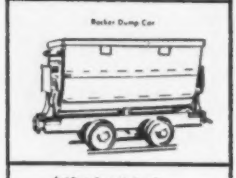

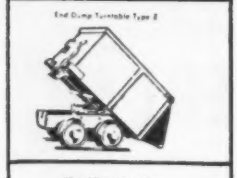

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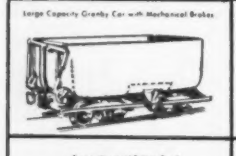

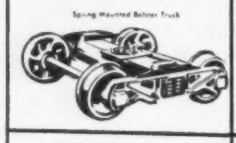

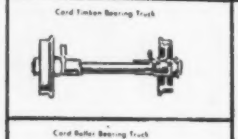

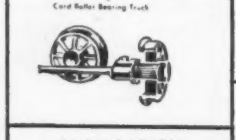

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Nevada *(Continued)*

crew of 125 men went back to work. Hiring was resumed the first week in April after a shutdown which had kept the big dredge and mill inoperative since mid-February due to ice, snow and cold weather. Former employes were given preference. Operations are now being carried on five days a week with three shifts per day. The operation is situated in Nye County north of Tonopah. J. H. Ashley is general manager for the company.

Vic L. Smith is moving equipment for strip operations onto his property northeast of Tonopah, and work in developing the 1,600-acre area is due to begin soon. A four-mile access road to the site has been constructed by Gene Lock and Pete Jagles, of Tonopah. Assays by Ed Eisenhauer, of Los Angeles, are reported to show nine pounds of lithium, five pounds of cerium and three pounds of lanthanum per ton.

Development work on the One Little Girl in Blue at Goldfield is underway by Harry Boucher and Johnny Lambert of Los Angeles. The two Californians bought the property several weeks ago from Fred Bremer, of Esmeralda County, and ore samples proved encouraging. Equipment has been purchased and moved onto the site.

United States Mining & Minerals Corp. has concluded a lease-purchase agreement for the Mohawk mine situated in the Argentite mining district of Esmeralda County, 26 miles west of Silver Peak where U. S. Mining & Minerals operates its big mill. The deal was made with E. J. Shirley, L. H. Shirley, H. R. Humphrey and S. M. Chiatovich, of Silver Peak and Tonopah, owners of the property. The transaction involves $400,000 for the six unpatented mining claims in the Mohawk group. Extensive development of the site was done in 1955 by Sunshine Mining Co. and by the Bruhi interests in 1956, during which years more than 100,000 tons of good mill ore with silver values running 30 to 40 oz per ton were blocked out.

U. S. Mining & Minerals has done extensive research work in developing a sulphide leaching process for recovery of the silver values, and has already begun mining the Mohawk ore. The camp at the Mohawk site, complete with mess hall and bunk houses, has been activated. Additional milling facilities to handle the ore were to be completed by June 1, at which time the mill will be able to handle 60 tpd from the Mohawk in addition to the regular tonnage from the Ohio mine at Goldpoint and the Tonopah King at Tonopah. The new ore supply is expected to add $750,000 per year to present bullion shipments from the mill.

Big Divide Mining Corp. has increased activity in the long-dormant Tonopah Divide mine near the Nye County seat. Under direction of James Smith a tunnel is being driven into the southwest slope of Gold Mountain aimed at cutting the gold vein which produced much high

EVERYTHING'S BIG ABOUT THE D9

...*including economy!*

You don't sacrifice economy for big production when you step up to a Cat D9 Tractor. When you see big loads of pay dirt rolling in front of a D9—those can be the most economical yards in strip mining today!

Arrington Mining Co. has found this out at its open pit iron ore mine at Troy, Alabama. Its D9 with No. 9S Bulldozer economically strips overburden that is up to 25 feet thick.

Besides, partner Tom Arrington says, "The D9 is worth what you pay for it in dependable service—and I find Cat machines have a high resale value."

Many features contribute to the outstanding economy and resale value of the big D9. To name a few: dependable Cat Diesel Engine with new dry-type air cleaners, the exclusive Caterpillar oil clutch, strong main frame and final drives, long-lived, extra-rugged undercarriage, including lifetime lubricated rollers and idlers.

Get all the facts on the mighty D9—and a demonstration on your strip mining operation—from your Caterpillar Dealer.

Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

CATERPILLAR

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Look to ATLAS COPCO first...for:

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- *Detachable Carbide Bits*
- *Stationary and Portable Compressors*
- *Flood Lights* • *Hoists*
- *Cobra Motor Drills and Breakers*
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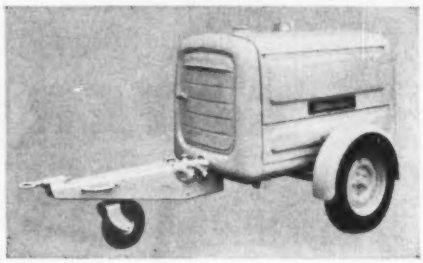

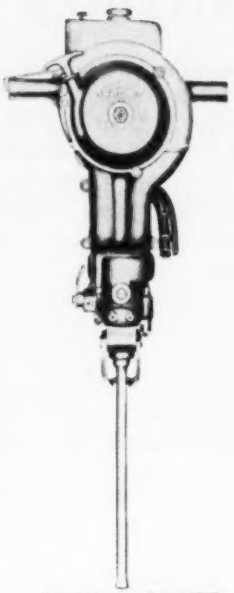

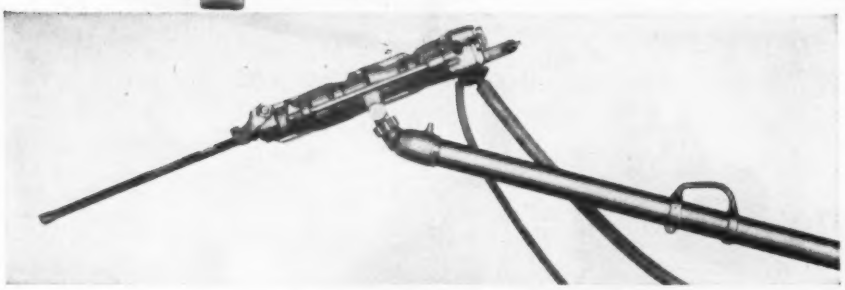

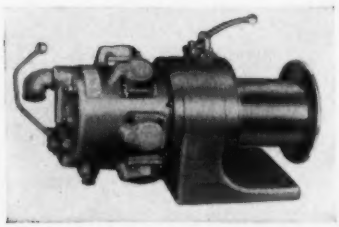

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Atlas Copco and Coromant equipment, contact:

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Atlas Copco

Here's proof Coromant rope-thread bits and steels SAVE TIME AND MONEY

"Up to double the footage between sharpenings!"
"Premature rod breakage is almost non-existent!"
"40% more usable life—more resharpenings!"
"Bit and rod life are well above average!"
"Uncouple by hand all the time!"
"More rigid—drills straighter holes!"*

**Names of men quoted available on request*

The comments above are actual quotes from project managers, job superintendents, and drill superintendents who have tested new Coromant rope-thread bits and steels. They've learned, on-the-job, the benefits they—and you—can expect!

For example: The new rope-thread (only two turns per inch) holds tight in use, yet permits hand uncoupling. Reports show that the time saved results in more footage drilled per shift. Bit footage is well above average too, with less loss of carbide inserts. Prime quality ore plus nickel-chrome alloy permits cold-rolling from billets for greater strength, life and rigidity. And only with Coromant rope-thread steels can you re-thread without heat treating, too. Do it yourself, or at any nearby machine shop.

Want to know more? There's no obligation on your part, but we'll be glad to help where we can. Just call your nearest Atlas Copco Office, or write to us at Dept. EMJ-7.

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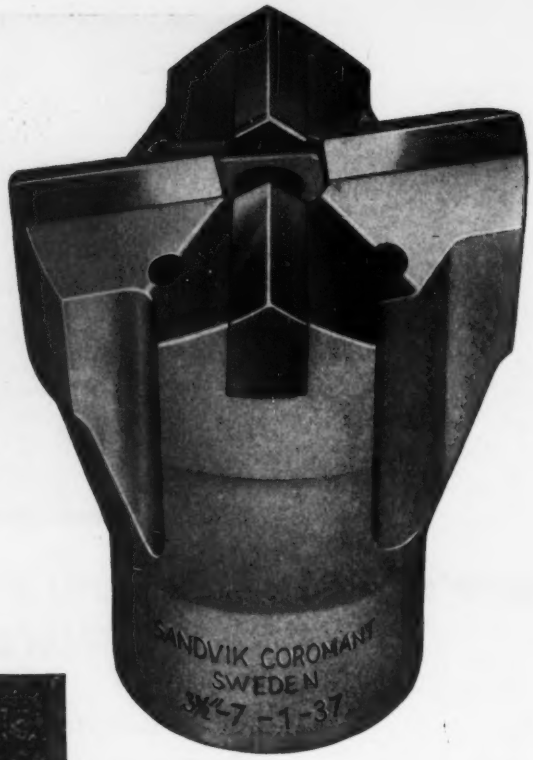
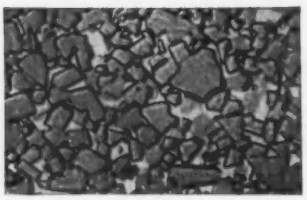
Longer bit life— with *new* Sandvik Coromant Bits





Sandvik Coromant Tungsten Carbide (Microphoto) Uniformity of size, even distribution of grain are marked. Free from porosity and impurities —therefore stronger, longer-lived.

Low quality Tungsten Carbide (Microphoto) Black marks are contaminations caused by deficient production control. They weaken the carbide, reduce its working life.

NEXT time you buy bits, specify Sandvik Coromant because they give more footage per bit, lower drilling costs. Here's why:

1 Only first-quality tungsten carbide is used —as shown in the microphotos above. This means less wear, longer life and a better job.

2 The bodies are precision-made of high quality alloy steel—tough enough to take the strain throughout the extra-long bit life.

3 The bigger Sandvik Coromant bits are all of X-design, which prevents rifling. No wonder Sandvik Coromant inserts are the most widely used in the world, drilling more than one billion feet every year.

SANDVIK COROMANT bits are supplied through Atlas Copco, the world's largest manufacturer of rock drills, who also supply Sandvik Coromant integral steels — the most widely used in the world — and Sandvik Coromant extension steel equipment.

Sandvik Coromant Detachable Bits are Available in the following Thread Sizes and Bit Diameters

Type	Thread	Available Diameters, in Inches															
		1¼	1⅜	1½	1⅝	1¾	1⅞	2	2⅛	2¼	2⅜	2½	2¾	3	3½	4	4½	5
SHOULDER	TAPER	x	x	x	x													
	F		x	x														
	113		x															
	H			x	x	x	x	x		x								
	115			x	x													
	D						x	x	x	x	x	x	x	x				
	K													x	x	x	x	
BOTTOMING	1" Rope				x	x	x	x		x								
	1¼" Rope						x	x	x	x		x		x				
	400						x	x		x		x						
	1½" Rope											x	x	x	x	x		
	600											x	x	x	x			
	700													x	x			
	J7.5															x	x	
	2" Rope														x	x	x	x
	1000																x	

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Nevada *(Continued)*

grade gold at the surface in years past. At a depth of 700 ft highly mineralized vein material has been encountered, and work is continuing on a two-shift basis to determine width and values. Work was begun in August following a report by Harry Hughes, resident engineer and geologist for the operation. Ore will be shipped to the mill at Silver Peak. Officials of the Big Divide Mining Corp. are John Franks, president, and M. W. Chatten, vice president, both of Long Beach, Calif., and Herb Cowan, secretary-treasurer, of Tonopah.

Alaska International Corp., of New York City, has taken leases on cinnabar and manganese mining properties in Pershing and Humboldt Counties, and announces that operations on the sites will begin soon. Humboldt County leases include the Victory Manganese claims ten miles south of Golconda, owned by Homer Winters, of Winnemucca, and a manganese development south of Winnemucca in the Mount Tobin area. The Victory claims were worked until recently by Western Mining Corp., of Lovelock. In Pershing County the firm has leased cinnabar properties belonging to Walter Polkinghorne, Virgil Olson and Earl Simpson, all of Winnemucca. The property lies ten miles south of Unionville. Rush Meadows, of Charleston, W. Va., engineer and geologist for Alaska International, has spent much time examining mining properties in northern Nevada during the last two years in his connection with Minerals Exploration Co., also of New York.

Getchell Mine Inc., has been making extensive explorations for gold ore on its property since tungsten mining and milling operations were discontinued in 1958. George Wingfield Sr., president of the corporation, reports that favorable areas in the Getchell vein along its strike for a distance of eight miles were drilled. One new orebody containing both oxide and sulphide deposits was located south of South Pit and north of Riley Extension tungsten mine. Further exploratory work is continuing in the area by a system of shafts, cross-cuts, drifts and raises to investigate the extent of the deposit. Work is expected to last several months. No new equipment will be required for milling gold sulphide ore when sufficient tonnage for milling has been produced, Wingfield said. Modification will be required for milling gold sulphide ore, and extensive research in such extraction methods has been conducted during the last year. Originally a gold-producing mine, Getchell properties were changed to a tungsten producer during several years until 1958. Plans now call for resuming the gold output. Due to its shutdown, the company lost $78,179 during 1958, Wingfield's report said.

White Caps Gold Mining Corp. has bought the Lowboy uranium claims east of Austin from William Wilson, of Tonopah, and Glen Woods, of Reno. The price was $335,000, a large part of which was made as down payment with the rest to be paid in the form of roy-

HUBER-WARCO
motor graders

keeps haul roads clear for payloads

Earth rolls off the moldboard as the Huber-Warco MOTOR GRADER quickly and efficiently performs its grading assignment. Huber-Warco MOTOR GRADERS with torque converter, tail-shaft governor and power-shift transmission make faster passes with smoother cuts . . . gives more profitable grader operation. Once the operator sets the desired speed it is maintained by the tail-shaft governor, regardless of load conditions. Operators also like the easy maneuverability and the fact that there is NO CLUTCH in the torque converter models provides a new ease of operation. An exclusive feature of Huber-Warco MOTOR GRADERS is the completely cab-controlled hydraulic blade movement for bank sloping. In less than a minute, and without ever leaving the cab, the operator can move the blade from a 90° bank sloping position on one side to 90° on the other. There are NO manual adjustments to be made. Huber-Warco torque converter and standard transmission MOTOR GRADERS range from 75 to 195 h.p. See your Huber-Warco distributor for complete details.

A product of HUBER-WARCO COMPANY, Marion, Ohio, U. S. A.

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☐ Send me the name of my nearest Huber-Warco distributor.
☐ torque converter ☐ standard transmission

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HUBER W WARCO

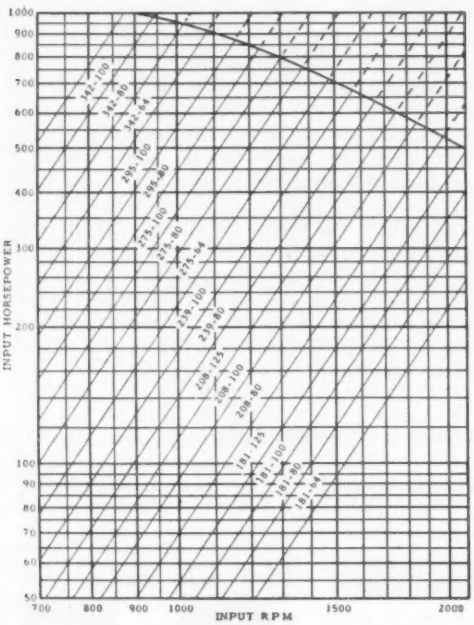
Plan now to DESIGN with National Torque Converters

for Internal Combustion Engine or Electric Motor Applications

Available with or without integral cooling systems

The six sizes and 17 hydraulic circuits available in the National Torque Converter line permit the exact matching of converter to internal combustion engines or electric motors from 100 to 1000 hp., and to job. Proper unit can be easily selected on chart below; find input rpm on horizontal scale, input HP on vertical scale. Diagonal area at point of intersection will show size and circuit needed. Curves showing torque-speed ratio for converter you select are available on request.

For more detailed technical information, ask for a copy of Bulletin 468.



Consider these National Torque Converter features

- Simplicity of Design for ease of installation, operation and maintenance
- Full Range of Circuit Sizes permits exact matching to internal combustion engines or electric motors of 100 to 1000 horsepower
- Top Performance enables prime movers to operate at its optimum speed . . . deliver maximum horsepower constantly
- Reproducible Efficiency assures uniform top performance on every job
- Faster Job Cycles means more loads per equipment per operator per day
- Unsurpassed Durability provides longer service life with minimum maintenance

THE NATIONAL SUPPLY COMPANY

Subsidiary of Armco Steel Corporation

TWO GATEWAY CENTER, PITTSBURGH, PA.

Nevada (*Continued*)

alties. Also included in the sale were claims in the same area owned by Charles Cavanaugh, Orville Carlock and Robert Frank. Intensive mining activities have already started, and because the property was located prior to Nov. 25, 1957, the AEC will purchase all concentrates produced. Milling will be done by Vitro Uranium Corp.

The Lowboy claims include two large orebodies where 40,000 tons of ore have reportedly been blocked out. All overburden has been removed from No. 1 orebody and mining is by open pit method. The ore lies on a mountain side and is easily loosened and loaded. On No. 2 orebody a tunnel large enough to permit use of skiploader and trucks has been sunk. Stockpiling will continue until 1,600 tons of ore are on hand for shipment by truck to the rail head at Battle Mountain. Values are mainly autunite, but there are some showings of uranophane. Values run around 0.3% according to White Cap officials.

Hugh Cameron is mining superintendent, and Stanley Maestretti, of Austin, has been employed to construct access roads and do the stripping. White Caps officers are Carson Frazzini, president, William J. Crowell, vice president, and W. B. Naismith, secretary and treasurer. The firm also operates a gold mine and an antimony mine at Manhattan, north of Tonopah.

Improved methods of extracting uranium from low-grade ores are described in a report prepared by Prof. John N. Butler, research metallurgist at the Mackay School of Mines, University of Nevada.

The report covers contract work done for the Atomic Energy Commission by the Mackay School of Mines during a five and one-half year period.

Titled "Physical Beneficiation of Low-Grade Uranium Ores," the 134-page report is now available to the public. It may be obtained only from the Office of Technical Services, Department of Commerce, Washington 25, D. C.

NEW MEXICO

The nation's largest uranium mill at Grants, is reducing output at request of the Atomic Energy Commission.

The 3,500 tpd concentrator is the property of Anaconda Co. which on May 1 dropped operations of its carbonate leach circuit, cutting ore input rate to 2,800 tpd.

Albert Fitch, general manager, said the cutback was made at request of AEC with whom Anaconda is now concluding concentrates sales contracts extending through to Dec. 31, 1966. Present contract runs to March 31, 1962.

Mr. Fitch said that the mill cut back was made "in good faith" even though the mining company and the Commission have signed no contracts as yet.

Rate of production at the famous open cut Jackpile mine will be reduced correspondingly, he added. The mill will continue with RIP (acid leach) circuits.

"READY-TO-USE" DYNATEX* COSTS LESS THAN PRILLS

Extensive tests conducted in open-pit mines and quarries have shown that Dynatex produces rock or ore at a lower cost than prilled ammonium nitrate-fuel oil mixtures.

These tests, conducted under actual working conditions, proved that Dynatex permitted an increase in the distance between drill holes as well as an increased burden. Economies were effected all along the line. The explosives loading factor was reduced, as were loading time, labor, drilling, and blasting costs.

If you have, or are now using, a prilled ammonium nitrate-fuel oil mixture, be sure to test Dynatex on your next blast. Our technical representatives will be glad to show you how Dynatex blasting agent can cut your costs, too. Phone or write our nearest branch office for complete information.

NO FUSS—NO MUSS. No mixing on the job—Dynatex is delivered ready for use.

QUICK LOADING. In cartridges, Dynatex is quickly loaded into bore holes. Where conditions permit, Dynatex may be poured into bore holes.

UNIFORM STRENGTH AND QUALITY. Dynatex is a blasting agent of uniform known strength and dependability.

CHOICE OF PACKING. Dynatex is available in multiwall paper, special burlap or Flexo-Bag® containers, or in fiber drums of standard diameters.

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HERCULES

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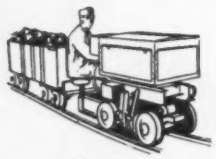
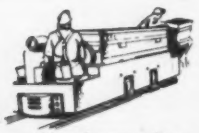
NEW EXIDE-IRONCLAD LOCOMOTIVE BATTERIES PACK UP TO 45% MORE POWER

APPLICATION	NEW TYPE BATTERY	CAPACITY PER POS. PLATE	REPLACES BATTERY TYPE	PERCENT CAPACITY INCREASE
 Trammers	MG	45 ah	MVM ML	32.4 17.5
 Mine locomotives	RG	55 ah	ML TLM	43.6 5.0
Shuttle cars	TG	72 ah	TLM TH	44.0 20.0
Battery locomotives	TEG	95 ah	(new type—no prior data)	
	MEG	145 ah	MEH MEX	45.0 21.0

Boost the work capacity of your locomotives

These new, advanced Exide-Ironclad Batteries pack more power in the same space. They equip your present locomotives to do more work. And they actually cost less per ampere-hour, promise even longer life of service. Get complete information. Call your nearby Exide representative. Or write Exide Industrial Division, The Electric Storage Battery Company, Philadelphia 2, Pa.

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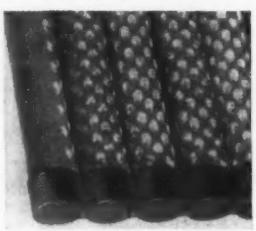


THE SECRET. New tubular construction packs more power in each positive plate . . . prolongs battery life.

NORTH CAROLINA

Cranberry Magnetite Corp., organized recently after two years of extensive research by Appalachian Exploration Co., has reopened the Cranberry Iron Mines at Cranberry, in the mountains of western North Carolina.

The mines, closed since 1931, are located 25 miles from Spruce Pine, center of the mica-feldspar-kaolin mining district, and were operated intermittently for half a century after 1881.

According to estimates by S. H. Hamilton, geologist of Philadelphia, Pa., "half a million tons of ore are blocked out and a possible several million tons of ore can be economically recovered in the present mine area."

The U. S. Bureau of Mines made a magnetometer survey of Cranberry and vicinity covering more than 5-million square ft and put down some 9,000 ft of core drill holes. It mined 1,400 tons of ore and in a pilot plant set up at the mine concentrated the ore to 70% iron.

At another pilot plant set up at Salisbury, USBM was able to produce from Cranberry ore some sponge iron containing 97% iron, reportedly equal in quality to sponge iron imported from Sweden.

Appalachian has removed some 30,000 tons of waste rock from in front of the mine entrance and when this material was crushed and passed over a magnetic pulley, more than 3,000 tons of ore was recovered. This indicates, it is said, that an estimated 50,000 tons of ore can be recovered from the old waste dumps, along with 450,000 tons of rock suitable for road material which is being sought by the North Carolina Highway Department.

OREGON

Lakeview Mining Co. has discontinued underground mining operations at its White King uranium mine and was to begin open pit production of uranium ore in May.

The company signed an agreement with the Isbell Construction Co., Reno, for expanding the stripping area already opened by Lakeview Mining. Initial stripping area will cover 700x400 ft.

Underground mining was discontinued because of problems presented by heavy ground conditions.

The change did not affect operations at the firm's uranium reduction plant near Lakeview.

TENNESSEE

Tennessee Copper Co. at Copperhill, is driving a drift 6000 ft long from their Central hoisting shaft to the new "School property" orebody. When the drift is completed, a new shaft will be sunk into the orebody to accommodate men and materials. The new shaft will be sunk in the cage raising manner that is now standard practice at Copperhill. A large diameter diamond drill hole is

engine power
BY CATERPILLAR

The New Cat D342 (Series C)

BRAND-NEW ENGINE WITH A 27-YEAR PERFORMANCE RECORD!

Can an engine with 27 years of hard and profitable contract work behind it be called new? Not with any degree of accuracy. This is especially true of the D342 (Series C). Yet, it is an engine made up of hundreds of newly engineered parts, compounded to provide an increased work range.

But there's far more to offering this new engine to meet the realistic needs of contractors than just knitting metals into horsepower at the drive shaft.

In 1931 Caterpillar introduced the first diesel engine in a track-type tractor. You've probably heard this before, but did you know that the four-cycle design employed in that engine is still found in every Cat Diesel? It was the best then; it's the best now.

Our original fuel system principle was so simple, easily maintained and economical that it has only been necessary to improve the parts.

Diesel engines have always required sizable capital investments. This has led to highly competitive pricing. Cat Engine quality standards are never lowered to gain an initial price advantage. Cat owners realize increased performance and profit that far exceed any difference in initial price that might exist between Cat Engines and competitive diesels.

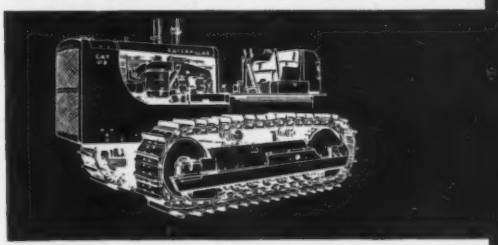
The former Cat D342 Engine has been redesigned, reshaped and improved in *all* of its many parts. These improvements help the mining industry produce more with tractors, shovels, electric sets, drills and other machines. This design progress will continue.

If this sounds like the kind of diesel engine or electric set that could fill a need on your job, specify the D342 (Series C) for your next machinery purchase, or see your Caterpillar Dealer for repowering. Send for the detailed D342 (Series C) brochure, *Form No. 20151-1.*

Engine Division, Caterpillar Tractor Co., Peoria, Illinois, U.S.A.

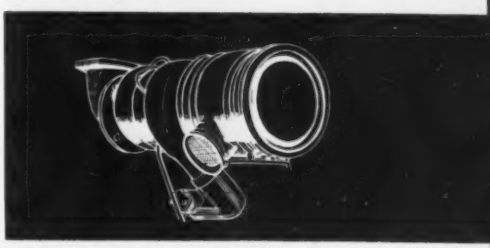
Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

Taking the gamble out of buying a new engine.



PERFORMANCE. D8 Tractors have long been made the standard for tractors. The former configurations of the D342 have contributed mightily to this high degree of acceptance.

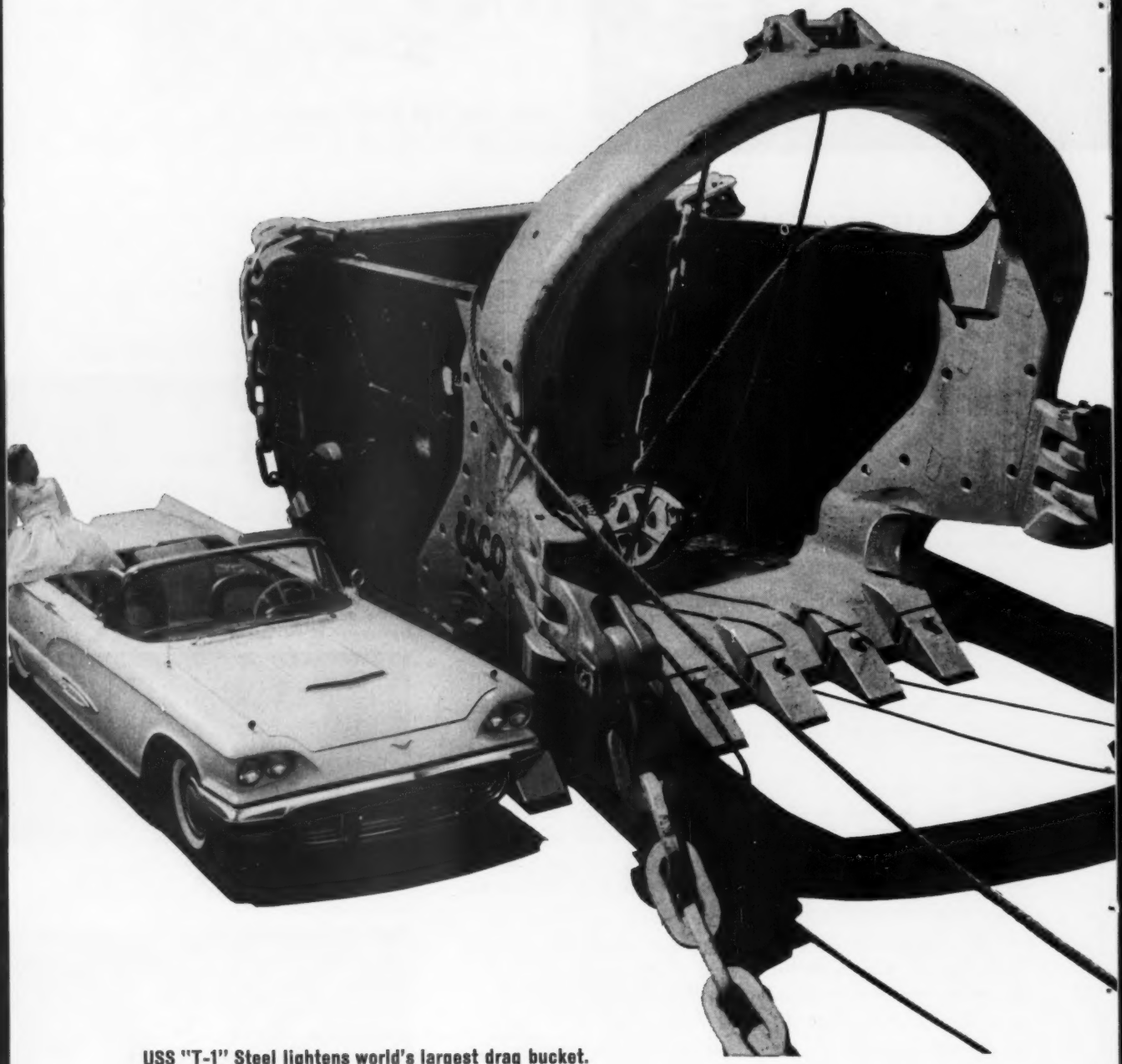
SERVICE. The new D342 (Series C) is backed with 24-hour availability of parts and service. Outstanding coal field service gives a big plus-benefit to buyers of every Cat Engine.



IMPROVEMENTS. Important advances include: (1) increased HP in all D342 (Series C) configurations; (2) turbocharging produces greater power capacity and fuel economy; (3) a new efficient air cleaner now has 99 plus per cent dust removal.

OTHER QUALITY FEATURES include valve rotators to provide prolonged and uniform valve seating, cast-in iron top ring band for longer piston and ring life, and crankshafts induction hardened and shot peened for greatest toughness and strength.

These steels do cost more—



USS "T-1" Steel lightens world's largest drag bucket.

This 35½-yard dragline bucket – the world's largest – was recently built by the Electric Steel Foundry Company, Danville, Ill. It will be used in the Central Ohio Coal Company's open pit operation near Zanesville, Ohio. The big problem was to obtain the desired capacity, strength and ruggedness with the least possible weight. To do this, the builder used super-strength USS "T-1" Constructional Alloy Steel plate in the sides, bottom and back. No other steel would provide such high yield strength (100,000 psi), weldability, and resistance to impact abrasion.

The completed bucket scoops 106,000 pounds of load but weighs only 69,000 pounds. Of this, 8,500 pounds are USS "T-1" Steel and 12,000 pounds are USS MAN-TEN High-Strength Steel, which has a minimum yield point of 50,000 psi. The weight saved by these two steels goes into extra load capacity and results in lower costs per cubic yard moved.

but they do more — and save more!

Today's mining equipment is the biggest, toughest and brawniest ever built. Much of its ruggedness and long life come from high-strength steels, new grades of super-strong, super-tough alloy steels, and stainless steels. *Special steels make the difference.* Today's special steels for mining equipment are stronger—tougher—more resistant to abrasion and corrosion. Every pound of these steels in your equipment means money well spent. Money that pays dividends by cutting dead weight, increasing payload, extending service life, reducing downtime and saving operating dollars. *USS, Cor-Ten, Man-Ten, Tri-Ten and "T-1" are registered trademarks*

Here are the USS Steels that do more:

USS MAN-TEN Steel—High-strength with abrasion resistance and economy. (Minimum yield point 50,000 psi)

USS COR-TEN Steel—High-strength with superior atmospheric corrosion resistance. (Minimum yield point 50,000 psi)

USS TRI-TEN Steel—High-strength with toughness, weldability and abrasion resistance. (Minimum yield point 50,000 psi)

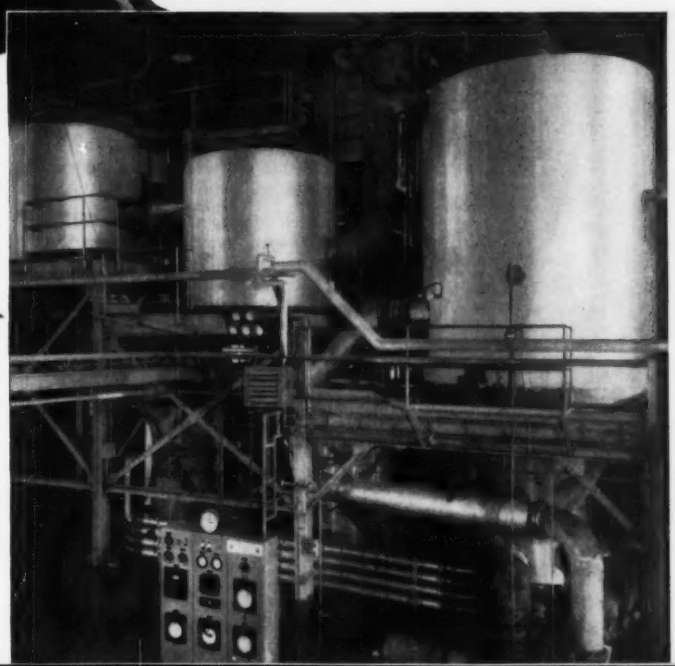
USS "T-1" Steel—Super-strength with impact abrasion resistance, weldability and toughness. (Minimum yield strength 100,000 psi)

USS STAINLESS Steel—High resistance to corrosion, elevated temperature and abrasion.

Each of these USS Steels is superior for certain applications. Our metallurgists will help you choose the best steel for your job. Contact our nearest sales office or United States Steel, 525 William Penn Place, Pittsburgh 30, Pennsylvania.

USS MAN-TEN Steel helps cut haulage costs.

This 50-ton Dart coal hauler operates at a rate of 5.9¢ per ton-mile. The old, smaller trucks cost 12.6¢ per ton-mile. These figures include truck operation, truck maintenance and other costs. Contributing substantially to the lower operating rate was the use of USS MAN-TEN High-Strength Steels which enabled the construction of larger trucks having 15% greater capacity than conventional units. In three years' time, no maintenance was required on the new trucks due to USS MAN-TEN Steel's high resistance to abrasion and impact.



Only Stainless Steel is good enough for this new extraction process.

Sheritt Gordon Mines, Ltd., Fort Saskatchewan, Canada, has a new method for extracting nickel, copper and cobalt from ore. The ore is dissolved in a bath of ammonium sulfate and ammonia and the metals are recovered from solution. Stainless Steel is the only metal that can be used in the pipes, tanks and pumps that give the "hot bath" of ammonium sulfate to the ore. Other materials can't take the corrosion and high temperatures in this work as well. Stainless has proved more economical than any other metal.

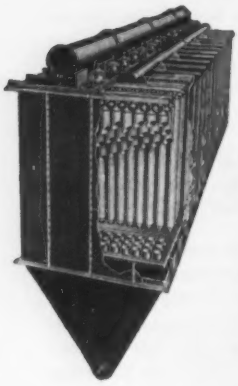
United States Steel Corporation—Pittsburgh
American Steel & Wire—Cleveland
Columbia-Geneva Steel—San Francisco
Tennessee Coal & Iron—Fairfield, Alabama
United States Steel Supply—Steel Service Centers
United States Steel Export Company

United States Steel

USS

THE NORTHERN BLOWER COMPANY

Mfrs. of Norblo Dust and Fume Collection Equipment
6410 Barberton Ave., Cleveland 2, Ohio



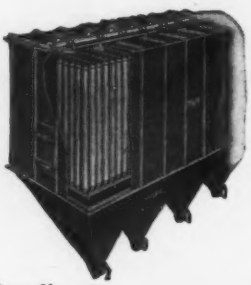
PRODUCTS: Automatic and Semi-Automatic Bag Type, H. E. L. S. Cyclone or Centrifugal Type, Hydraulic Type Dust and Fume Collectors, Cement Air Cooling System, Self-Contained or Portable Bag and Filter Type Units, Exhaust Fans . . . All designed and fabricated by our own shops.

Norblo Automatic Bag Type

For continuous or heavy duty service providing very high efficiency at very low cost of operation and maintenance. Basic unit contains 78 bags, 6" diameter, 8' 3" long. Air flow is upward, from inside, thus keeping bags fully distended. Total free cloth area per compartment 936 square feet. Shaking and cleaning controlled by electric timer, is cyclic, one compartment at a time, each having its individual compressed air shaker mechanism and the whole system variable and adjustable for dust load without shutting down. Mechanical (electric motor) operation available. Any compartment can be cut out without affecting others. Access to interior is on the clean air side.

Norblo Standard Bag Type

For intermittent service, as fan and unit must be shut down for cleaning, usually at noon hour and end of working day. Electrical or compressed air shaking and cleaning mechanism. Basic unit has 40 bags 6" diameter, 8' 3" long, 480 square feet cloth area. In both Standard and Automatic bag types made by Norblo, extra large hoppers provide air expansion space resulting in great drop in air velocity and a maximum degree of dust separation by gravity before passing upward for final filtering.

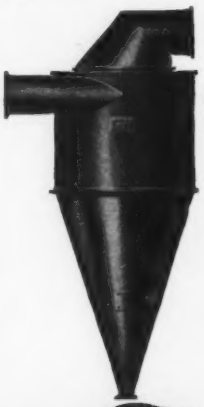


Norblo Hydraulic

A high efficiency, wet type collector, for separation of dust mixed with smoke or fumes. In most installations the Hydraulic unit is used with a Norblo Cyclone collector, thus reducing the amount of wet sludge to be handled. There are no moving parts. Filter beds are coke or high-fired ceramic tubes, light in weight and kept in motion by ascending air stream so that beds are self-cleaning. Built in 11 standard sizes with capacities up to 26,000 cfm.

Norblo H. E. L. S. Centrifugal

A cyclone or centrifugal type collector for all materials, from saw-dust to fly ash; characterized by high efficiency of collection with low static drop. The Norblo H. E. L. S. has no internal vanes, gadgets or dampers. High efficiency is obtained by scientific proportioning and by the patented (No. 2,259,919) expanding nozzle. These design features eliminate the power-wasting back eddy. Built in standard sizes with capacity up to 37,500 cfm.

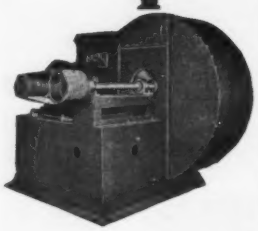


Norblo Portable Units

Self-contained units for efficient, de-centralized dust collection. Convenient, space-saving; can be located close to the dust source. Made in six sizes in bag types with capacities from 300 to 1350 cfm. All models have 8" static at fan. Fans exceptionally quiet.

Norblo Exhaust Fans

These high speed, low power fans have been developed especially for dust collecting systems and by proper wheel selection are adaptable to all types of materials handling. All wheels are statically and dynamically balanced. Heavy duty bearings are standard equipment.



Tennessee *(Continued)*

drilled from the surface to connect with the drift below. Then a steel cable from a hoist on the surface is lowered down the diamond drill hole and connected to a stage in the drift. Men working on this stage drill out a round much as driving an upraise. Upon completion of the drilling cycle, the stage is lowered to drift level, disconnected, and the cable pulled to the surface before the round is shot.

Tennessee Copper expects the new "School property" orebody to replace production lost when the famous Burra-Burra mine was closed down in June 1958. The new orebody is expected to produce as much sulphur as the Burra-Burra mine, but the grade of copper will probably be less than the 1.61% average grade of Burra-Burra.

After a year and half of idleness, the No. 2 blast furnace of Tennessee Products and Chemical Corp.'s Rockwood plant resumed operations May 15. The company produces pig iron and ferro-silicon.

The No. 1 blast furnace was placed back in operation last November, after being idle for more than a year.

UTAH

Union Carbide Nuclear is resuming run of company-owned or controlled uranium ores from the Temple Mountain district in Emery County.

The carbonaceous Temple Mountain ores are being treated at Union Carbide's Green River "up-grader" with concentrate going to Rifle mill. This is part of the 1,000 tpd Rifle "complex" which also includes an up-grader at Slick Rock, Colo.

The ores were not run during 1958 because of metallurgical difficulties which have now been overcome, a firm spokesman at Grand Junction, Colo. said.

As a result of company ore being treated at Green River, custom shippers have been reduced in their amounts under terms of the contracts existing between Union Carbide and AEC.

Existing contract provides that 25% of the 1,000 tpd capacity shall be devoted to custom shipments to the Rifle complex. Union Carbide said that during 1958, custom shippers accounted for 50% of this allocation.

Bear Creek Mining Co. has cut an 84 ft lead-silver-zinc ore zone in its Tintic District exploration program.

But Tintic Standard Mining Co. a partner to the explorations, didn't tell stockholders in annual report what the grade or nature of this deposition at 1,050 ft was.

Bear Creek is a wholly-owned exploration affiliate of Kennecott Copper.

H. E. Raddatz of La Jolla, Calif. and Salt Lake City, president of Tintic Standard, said that "both Bear Creek and all lessors agree that the exploration work (off the Burgin shaft) has been progressing very satisfactorily.

NEW GK DYNACLONE - DUST FILTER

Utah *(Continued)*

EIMCO *design and production*

PROGRESS REPORT

B - 395

Process Engineers, Inc., division of The Eimco Corporation: 420 Peninsular Ave., San Mateo, Calif.

World's Largest Covered Thickeners in Operation At U. S. Borax & Chemical

Four 230 ft. dia. Eimco-Process heavy-duty thickeners have been in operation for over a year at the United States Borax and Chemical Corporation refinery in Boron, California. These totally enclosed and insulated thickeners, largest of their kind in the world, are part of the CCD circuit from which the strong Borax solution goes to crystallization.

The thickener designs, developed in close cooperation with Pacific Coast Borax Division personnel and the engineering constructors, are custom-adaptations of Eimco-Process Type CX mechanisms. The cover of each unit is supported from radial trusses receiving central support from an 8 ft. dia. concrete column with steel shell that also carries the entire weight and torque of the thickener mechanism. The drive-head with split main gear and bearing was designed to the specific requirement of providing easy maintenance access. A special liquid seal was devised to protect the drive unit from tank vapors, as well as to ensure close control of process conditions.

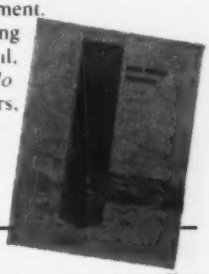
Four totally enclosed Eimco-Process thickeners at Boron, California

Other installation features were the resting of the steel thickener tanks on oiled sand for corrosion prevention; continuous torque recording; and handling the thickener underflows with steam driven reciprocating pumps.

This $20,000,000 processing plant, on an 80 acre desert site, was designed and constructed by Southwestern Engineering Company and Ford J. Twaits Company as a joint venture. It has substantially increased the U. S. Borax capacity and is playing an important part in the production of high energy boron fuels for the space age.

NEW BULLETIN AVAILABLE

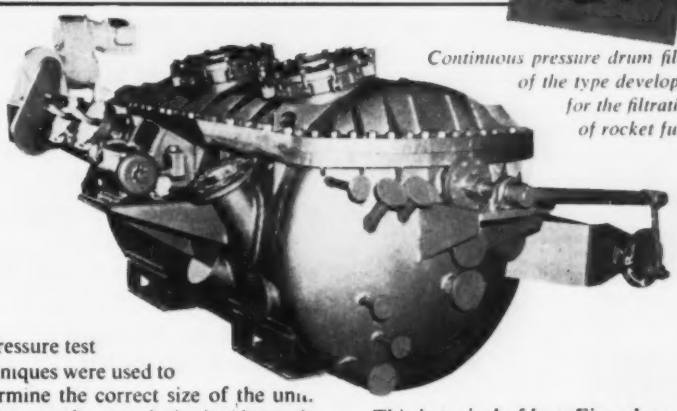
We recently completed an eight page bulletin describing our thickeners, hydroseparators, air-lift agitators, reactor-thickeners, slurry mixers and related equipment. It also covers recent design innovations such as our unique Thixo arms and platform lifting devices, and should be in your reference library even if your immediate plans do not include thickening equipment. A request will bring one by return mail, or, if your plans *do* involve thickeners, our nearest sales engineer will deliver a copy in person.



Eimco Filtration Equipment Plays Important Role in Producing Rocket Fuels

At another plant, producing high energy fuels, engineers were faced with a troublesome filtration problem. They had to filter a fuel having an extremely low slurry viscosity, a high percentage of hydrogen in the gas, and containing a dangerously flammable material.

This problem was referred to Eimco's Research and Development center at Palatine, Illinois. Here, the Company's filtration research engineers, after a series of tests, were able to work out special adaptations for a continuous pressure drum filter that met all the specialized application requirements.

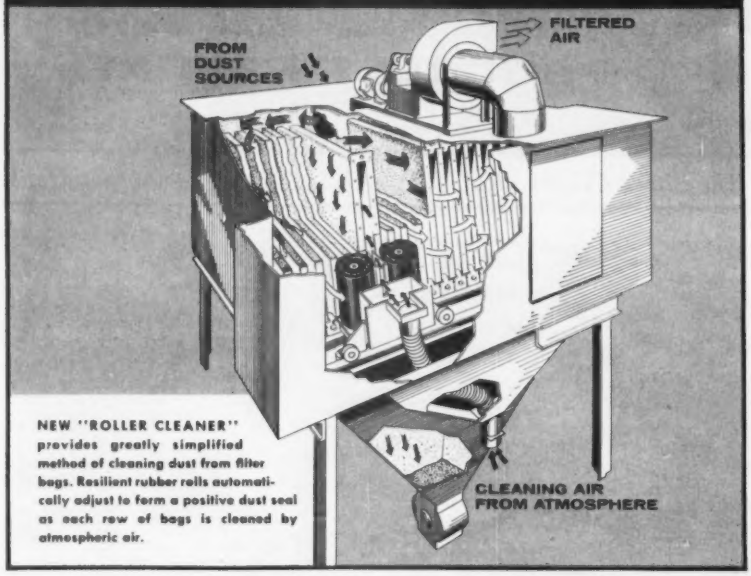


Continuous pressure drum filter of the type developed for the filtration of rocket fuels

Pressure test techniques were used to determine the correct size of the unit. Intricate seals were devised to keep air out of the pressure vessel. Changes were made in the hydraulic system. And, the filter was furnished with complete instrumentation.

This is typical of how Eimco's unexcelled research facilities and valuable backlog of experience in engineering custom-designed filter equipment can solve difficult filtration problems.

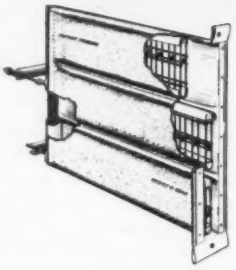
NEW *SLY* DYNACLONE® DUST FILTER



NEW "ROLLER CLEANER" provides greatly simplified method of cleaning dust from filter bags. Resilient rubber rolls automatically adjust to form a positive dust seal as each row of bags is cleaned by atmospheric air.

Patent Nos. 2583039, 2695681, 2867289. Other Patents Pending.

NOW! As Much As 3 TIMES LONGER FILTER BAG LIFE



NEW SLY "RESIST-O-WEAR" FILTER BAGS (patent pending) provide complete dust filtration with as much as three times longer life than conventional bags. This has been proved on the toughest field installations.

The new bag has three equal-size sections. Each pocket has two spacers, making a total of six per bag. Weight is distributed on three seams rather than one, minimizing strain. A special protective flap on the back end prevents abrasion from incoming dust.

Now standard in the new "Roll-Clean" Dynaclone, Sly "Resist-O-Wear" bags combine with all the other superior Dynaclone features to assure greatest dust collecting efficiency with unequalled maintenance-free service.

ALL THESE FEATURES IN ONE DUST FILTER

- New "Resist-O-Wear" bags last as much as three times longer.
- Free-rolling cleaner. Complete dust seal—automatic seal adjustment.
- Constant suction at dust sources—complete dust collection.
- Greater filtering capacity; smaller space requirements.
- Automatically self-cleaning for continuous operation.
- Simplified construction for ease of inspection and servicing.

SEND FOR New Bulletin 105 and New 36-page Dust Control Catalog 104.

SINCE 1870 SLY

THE W. W. SLY MANUFACTURING CO.

4758 TRAIN AVENUE • CLEVELAND 1, OHIO
OFFICES IN PRINCIPAL CITIES

OVERSEAS LICENSEE: ANDREW AIR CONDITIONING LTD., LONDON S.W. 1, ENGLAND

Utah *(Continued)*

"Drifting and drilling have disclosed an extensive area of mineralization—with some ore values—lying mostly below the 1,050 ft exploration level," Raddatz said.

"A drift on this level went through 84-ft of ore," he said. "An extremely complicated fault condition in the west end of the workings has so far thwarted finding the position of the Eureka Standard fault zone, which is one of the objectives of the work on Bear Creek's part," he said.

During 1958, Bear Creek completed 7,970 ft of exploration drilling on this program and 2,032 ft of underground drifting and cross-cutting off the Burgin shaft. Since start of the project in 1957, the Kennecott affiliate finished 22,772 ft of drilling and 4,199 ft of underground workings, including the shaft sinking project itself.

Park City Consolidated Mines Co. says it has shelved its operations at Crested Buttes lead-silver-zinc district in Colorado and returned to an appraisal of original holdings in Utah's Park City district. (The company is not to be confused with United Park City Mines.)

Carl Stehle, New York City, company president, said that the appraisal concerned the high silver—zinc ores in Utah. Crested Buttes operations have been stalled because of closure of the mill of American Smelting and Refining Co., with whom Park City Con had a joint venture arrangement.

Consolidated Eureka Mining Co., controlled by the Hogle interests of Salt Lake City, shipped only 360 tons of lead-gold ores from the famous Eureka District of Nevada in 1958.

James E. Hogle, president, said in annual report that low lead prices and increased freight and treatment charges adversely affected operations. The firm had a net loss of $145,772 last year, compared to a net profit of $26,486 in 1957, when 3,431 tons of ore were shipped to Midvale smelter. 1957 shipments were largely exploration ore from the famous "cave" systems developed nearly 70 years ago.

Con Eureka continued explorations during 1958, Hogle said. The 600-ft level of the mine was tied into the old Prospect Mountain Tunnel, driven in the 1890's, providing a new adit to the Con Eureka mine. "This common level is now the working adit in the mine," Hogle said. "A 600-ft vertical underground shaft was sunk to a new main level (750) to open this area for mining and development."

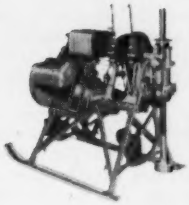
An ore shoot from the 320-ft level was intersected on the 500-ft level and is being mined and developed as well as followed, as there are indications it continues below the 650-ft level. The cave system was again cut on the 750-ft level. It was from this cave system that much of the 1958 ore was shipped. The Eureka district cave system is above major workings exploited in the early boom days of the district.

Standard Uranium Corp., Moab, is ship-

Utah *(Continued)*

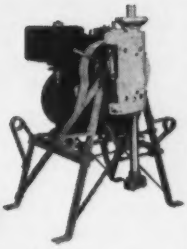
costs and taxes—adding that he hoped

trict of Colorado was underway. He



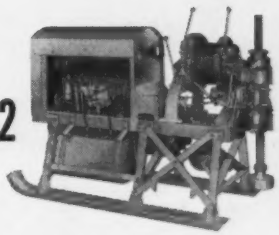
BBS-1

World's best known surface drill. Handles "E" Rods to 1,500 ft., "A" to 1,100 ft.



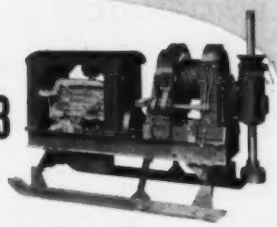
x-ray

Compact, portable—185 lbs. net. Takes ¾" or ⅜" core to 200 ft. Low fuel consumption.



BBS-2

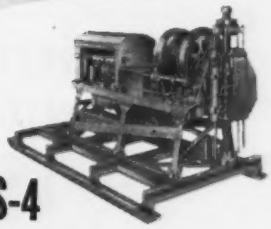
Versatile, choice of 5 swivelheads. Depths to 3,500 ft. Gas or diesel.



BBS-3

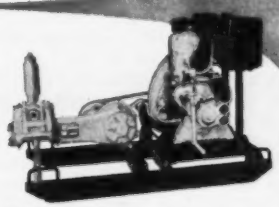
Strong, speedy unit for deep drilling . . . 4,600 ft. with "A" or "B" Rods, 95 h.p. diesel.

if it's for diamond drilling we make it!



BBS-4

Drills to 5,000 ft. with "B" Rods. Moves under own power, gas or diesel.



drill pumps

5-12 and 4-7 models. Capacities 400 to 1,200 g.p.h. Diesel motor optional.

permaset bits

(Powdered metal)

All standard sizes available from stock. Also reaming shells, etc.

bazooka

Portable. One man sets up in stopes or raises without mining bar or sprags. Capacity 200 feet with "E" Rods.

JV

4 feed swivelhead. Capacity 800 ft. with "E" Rods. JVR with right-hand feed screw for blastholes.

BBU-2

Rugged. Capacity 1,800 ft. with "E" Rods, 1,400 ft. with "A", four gear speeds.

VEG

Vane motored version of J.V. Lightweight, compact construction. Can be speedily dismantled into two units.

58-5

BOYLES BROS DRILLING COMPANY LTD VANCOUVER, CANADA

BOYLES BROS. DRILLING CO. LTD., NEWCASTLE-ON-TYNE, ENGLAND • BOYLES BROS. (PTY.) LTD., JOHANNESBURG, SOUTH AFRICA
BOYLES BROS. (PTY.) LTD., KITWE, NORTHERN RHODESIA • ATLANTIC, GULF & PACIFIC COMPANY OF MANILA, MANILA, PHILIPPINES
DR. ALBERTO BIANCHI, MILANO, ITALY • CIA. "DIAMANTINA B.H." S.A., LIMA, PERU • DIMITRY SCALISTIRI, ATHENS, GREECE
FORMAC S.A., RIO DE JANEIRO, BRAZIL • HAEHRE AND COMPANY, A/S, OSLO, NORWAY • ITEC, S.R.L., BUENOS AIRES, ARGENTINA
JOHANSSON & CIA., S.A., LA PAZ, BOLIVIA • SHRIRO TRADING COMPANY S.A., TOKYO, JAPAN • TRILLIANCE ENGINEERING CO., BOMBAY, INDIA • WIESE AND CA. LDA., LISBON, PORTUGAL.

Utah *(Continued)*

ping high grade uranium ore at rate of more than 10,000 tpm to three different mills, according to Russell Wood, general manager.

Mr. Wood said shipments in March averaged better than 0.70% U_3O_8 and grossed nearly $500,000 with $386,000 going to Union Carbide Nuclear at Green River, Utah; $140,000 to Uranium Reduction Co., Moab and $15,000 to Vanadium Corp. of America at Durango, Colo.

Mr. Wood said that Standard's new high grade orebody contains more than $15.5-million in values, after mining costs and taxes—adding that he hoped the AEC would permit the firm to mine out at least 70% of this reserve in the Big Buck mine during 1962—1966 concentrates purchase period. AEC has not yet given Standard a reserve allocation for this orebody for the period Nov. 1, 1957-Nov. 24, 1958. The reserve contains more than 850,000 tons of over 0.40% U_3O_8. But in one recent mine development, the firm benched an area and cut through a 50-ft thickness, from which 1,000 tons of ore averaging 1.25% U_3O_8 was taken!

Mr. Wood also announced that Standard's joint venture with Marcy-Shenandoah Mining Co. in the Silverton district of Colorado was underway. He expects that base metals prices will stabilize within the next 24 months, permitting this lead—gold—copper—silver ore body to be mined and milled profitably.

Hecla Mining Co. has reduced its uranium operations in Utah's Big Indian district from six to five days because of "limitations" imposed by the Atomic Energy Commission.

L. J. Randall, Wallace, Ida., did not detail the limitations effected at the Radon mine, for which Hecla is operator and holds net profit interest with Radorock Resources, Inc., Salt Lake City.

THE BIGGEST NEWS IN MINE VENTILATION TUBING . . .

BEMIS SAFETY YELLOW NYPRENE

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SAFETY YELLOW means just that . . . SAFETY! The yellow Nyprene material reflects light and is readily visible in darkness. It minimizes damage from punctures by machinery and equipment.

Then add these six other major benefits and you'll see why Bemis SAFETY YELLOW Nyprene FLEXIPIPE is your best ventilation value . . .

- Featherweight — fast, easy handling saves labor costs.
- Resistant to acid mine water, oil, grease, abrasion.
- Mildew-proof—will not rot even if stored wet.
- Stores compactly—requires small warehouse space.
- Tremendous tear and tensile strength.
- Long life, low cost, minimum maintenance.

Bemis also manufactures durable, economical Jute-grade FLEXIPIPE. Both types (Jute-grade and Safety Yellow) are available with Bemis Rope Seam Suspension at no extra cost.

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WASHINGTON

Officials of Utahcan, Inc., Spokane, reported that work is nearing completion on a concentrator unit being built at the firm's property in the Jim Creek district of Pend Oreille County.

Mill testing work is expected to start shortly. A crew was kept working at the property, located at a 4500-ft elevation, all through the winter.

A 1958 net loss of $122,088 was reported by Pend Oreille Mines and Metals Co. of Spokane. This is compared with a net loss of $132,752 the year before.

The firm's subsidiary, Reeves MacDonald Mines, Ltd., reported 1958 net income of $6,273 compared with a net income of $10,535 in 1957.

The Pend Oreille annual report said that operations at the Pend Oreille mine near Metaline Falls, included production of 607,695 tons of ore in 1958 compared with 757,197 tons in 1957. Receipts from the sale of concentrates amounted to $2,107,568 last year. The 1957 figure was $3,008,578.

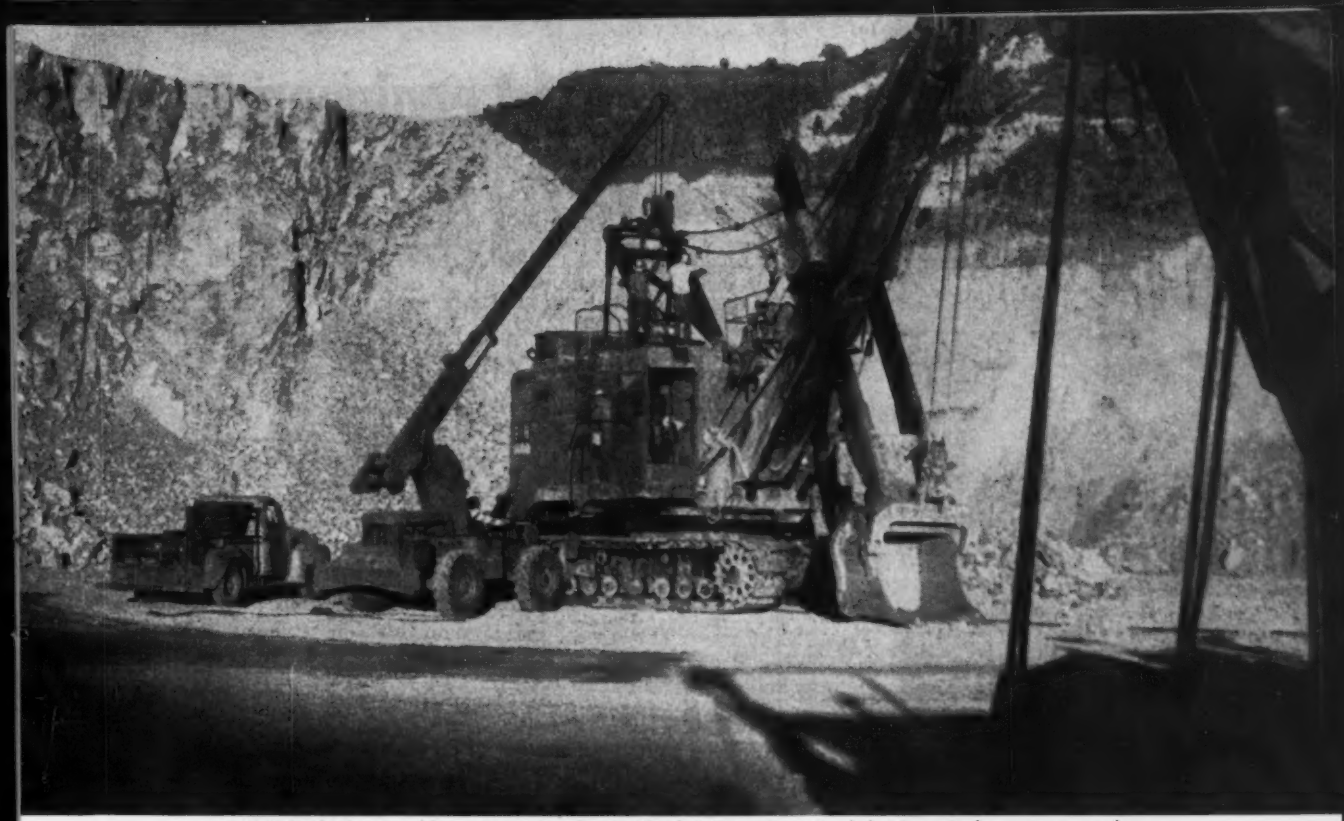
Officials said that an expansion program that included excavation for the incline shaft and crusher plant in a newly developed area was completed during the year. However, the installation of belts and the crusher was postponed because of unstable market conditions.

WYOMING

Green Mountain Uranium Corp., an affiliate of Phelps Dodge Corp., has let contract for driving of a 450-ft horizontal adit on its claims in the Crooks Gap district. Mining is scheduled to start this summer with shipment to the mill of Western Nuclear, Inc. where Green Mountain has allocation of 78,000 tons annually. Quad Construction Co., Riverton, has contract on adit.

Western Nuclear Corp. has started stripping of its Frazier-Lamac orebody in central portion of Gas Hills district—a program involving some 18-million cubic yards of overburden removal. About 1-million cubic yards will be removed monthly by Maco, Inc. (Boatright and Smith, Casper.)

In process of developing the pit, the



A-W Hydraulic Crane speeds repairs on giant shovel at Bagdad Copper Corp., Bagdad, Arizona. It also saves many costly man-hours on a host of other lifting jobs. The maintenance superintendent calls it the "handiest darn machine around here."

AUSTIN-WESTERN... speeds production, reduces downtime

A-W Hydraulic Crane saves maintenance man-hours

This is the most versatile tool yet developed for maintaining heavy mining equipment. Carries loads up to 5 tons, swings, lowers and spots them into exact position. All boom movements—raising, lowering, swinging and telescoping—have finger-tip hydraulic controls that can be used individually or simultaneously. All-wheel drive and oversize tires take it over the toughest terrain. All-wheel steer and a turning radius of 15 ft. 8 in. get it in and out of the tightest quarters, indoors and out. Can haul and spot cars on your sidings, yard or pit. As a rule, it will pay for itself in the first year by speeding repairs, slashing downtime, and saving labor.

A-W Power Grader at work in open pit mine of Midland Electric Coal Co. at Farmington, Illinois

A-W Power Grader for rugged road jobs

A-W Power Graders with all-wheel drive give you 30% more power where it counts—at the blade. In addition, this extra tractive power lets you grade access and haul roads where other machines would be hopelessly bogged down. All-wheel steer allows extreme maneuverability. Because of its power and stamina, an A-W equipped with a bulldozer attachment often saves the cost of a tractor-bulldozer.

Get complete information on these time and moneysaving machines from your nearby A-W distributor or write direct

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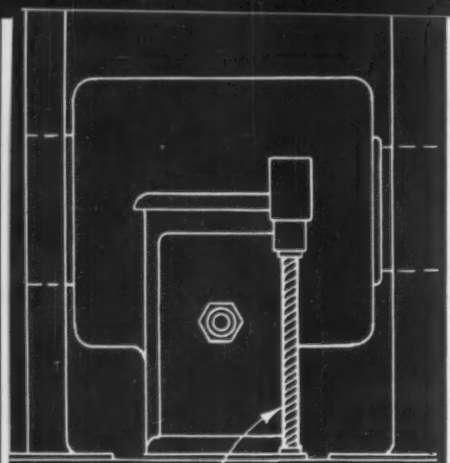
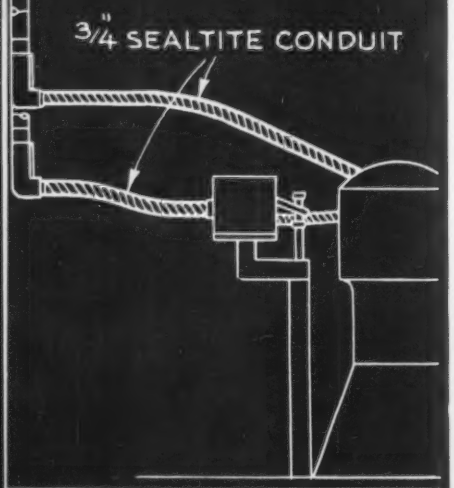
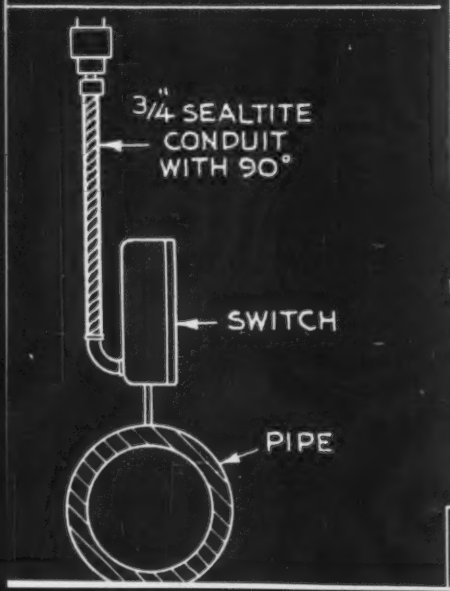






SEALTITE COMES IN THREE TYPES:

TYPE U.A.— TYPE C.S.A. Specifications for Type U. A. (Underwriters' Laboratories Approved) and Type C. S. A. (Canadian Standards Association Approved). Construction: flexible galvanized steel core, positive ground and tough extruded outer cover.

TRADE SIZE	INSIDE DIAMETER		OUTSIDE DIAMETER		APPR. INSIDE BEND	EST. WGT.
(Ins.)	Min.	Max.	Min.	Max.	DIAM.	(Lbs. Per 100 Feet)
⅜	.484	.504	.690	.710	6	30.0
½	.622	.642	.820	.840	7	36.6
¾	.820	.840	1.030	1.050	10	48.2
1	1.041	1.066	1.290	1.315	12	87.7
1¼	1.380	1.410	1.630	1.660	15	116.5

TYPE E. F. * is extra flexible—for machine tools and industrial equipment. It meets J.I.C. requirements.

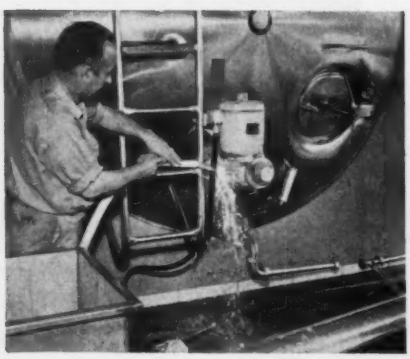
TRADE SIZE	INSIDE DIAMETER		OUTSIDE DIAMETER		APPR. INSIDE BEND	EST. WGT.
(Ins.)	Min.	Max.	Min.	Max.	DIAM.	(Lbs. Per 100 Feet)
⅜	.485	.500	.695	.710	5	24
½	.620	.635	.825	.840	5	29
¾	.815	.830	1.035	1.050	6	39
1	1.030	1.050	1.295	1.315	8	67
1¼	1.370	1.390	1.635	1.660	10	87
1½	1.575	1.595	1.875	1.900	12	105
2	2.020	2.040	2.350	2.375	15	135
2½	2.480	2.505	2.850	2.875	20	198
3	3.070	3.100	3.470	3.500	26	282
4	4.000	4.040	4.460	4.500	34	414

Commercial tolerances apply on above figures.

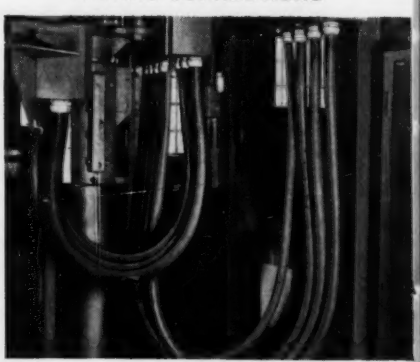
WHERE TO GET SEALTITE — Electrical Wholesalers stock Sealtite with gray or black cover in easy-to-handle cartons or on reels. Be certain you ask for and get the quality conduit marked "Sealtite" on the cover. Buy it in long lengths and cut it on the job without waste. Your wholesaler also stocks liquid-tight connectors.

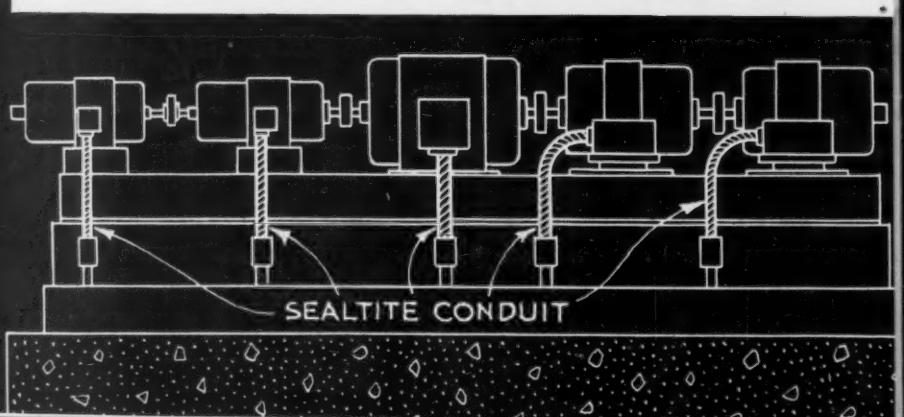
Free Booklet S-539 gives you full information on Sealtite. For your copy, write: Anaconda Metal Hose Division, The American Brass Company, Waterbury 20, Conn. In Canada, Sealtite is approved by Canadian Standards Association, and sold by Anaconda American Brass Ltd., New Toronto, Ont. *Pat. Applied For 58184 Rev.

FOR WET SPOTS



MOVING CONNECTIONS





from plans to performance insist on SEALTITE

the original flexible, liquid-tight electrical conduit that protects wiring against oil, grease, water, dirt, chemicals, corrosive fumes, salt spray, weather.

SEALTITE is a flexible *and* liquid-tight electrical conduit. It gives maximum protection to your wiring when it must connect moving parts, absorb vibration, follow machine contours, flex into U-bends, be easily maintained or be safeguarded between misaligned outlets.

It is being used successfully in wet locations, in tunnels, power plants, steel mills, canneries, chemical plants and in many outdoor applications.

CUTAWAY SECTION of Type U.A. Sealtite shows tough polyvinyl jacket over flexible galvanized steel core. Copper conductor wound spirally inside conduit gives positive ground.

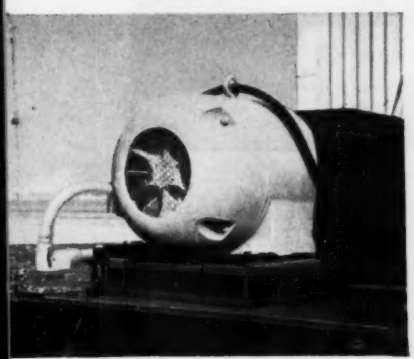
Insist on the conduit marked

SEALTITE®

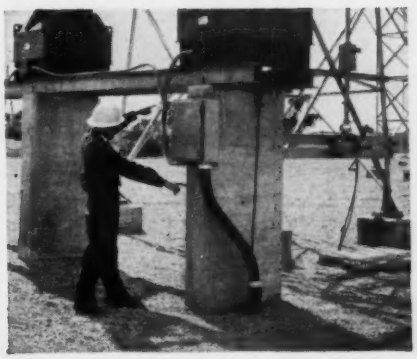
Flexible, Liquid-Tight Conduit

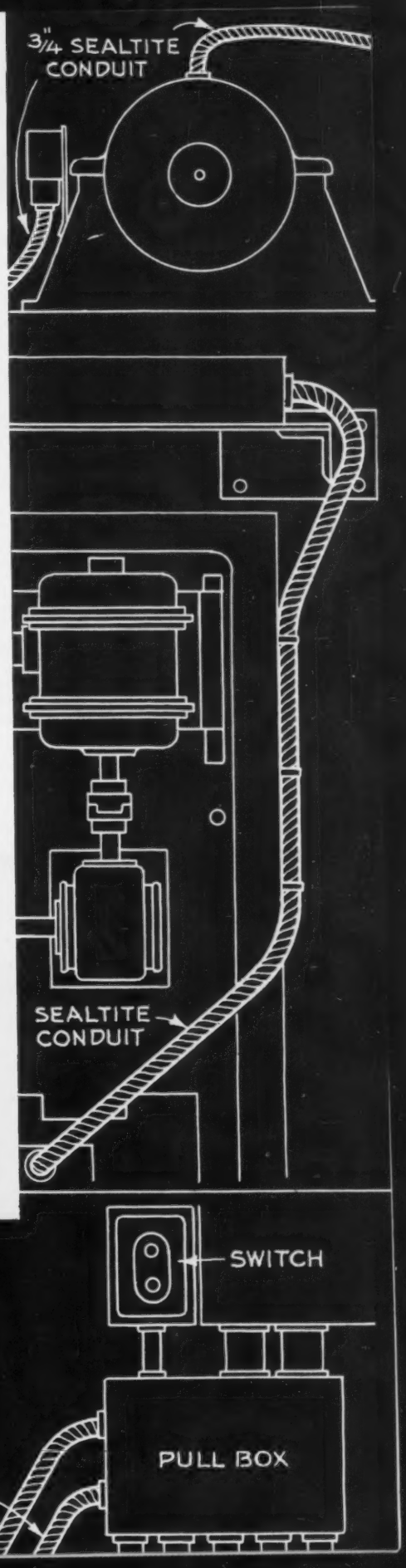
an* ANACONDA® *product

OUTDOORS



MISALIGNMENT





Wyoming *(Continued)*

operators will change ratio of removal on the existing open cut mine, now 1,100 x 660 ft on rim with bottom at 300 x 800 ft.

Lucky Mc Uranium Corp., with adjacent claims, will remove a portion of the wall between the two mining properties.

Main orebody on the Western Nuclear property is at 250 ft.

Antelope Mines, Inc., has sold its interests in Wyoming's Gas Hills district to Western Nuclear, Inc.

N. P. Juneman, Antelope manager, said Western Nuclear had agreed to do 20,000 ft of drilling on its properties.

Antelope's allocation is with the Freemont Minerals (Susquehanna Western) mill.

New Park Mining Co. expects to start receiving "substantial" dividends from its stock ownership in Lucky Mc Uranium Corp. during 1960.

W. H. H. Cranmer, Salt Lake City, NP president, says in annual report to shareholders that Lucky Mc will pay off loans in connection with Gas Hills uranium mill construction by end of this year—pay dividends in 1960.

Elsewhere in annual report, he announces a grant to NP of an "extensive" line of credit from prominent New York investment banking house for completion of $800,000 DMEA exploration project for copper in west portions of the Mayflower mine, Park City district.

NP also has interests in Affiliated Oil Inc's 129-billion cf natural gas field in Grand County and stake Yale Gold Mining Co. in explorations in Nevada.

He termed New Park a "pioneer" in diversifying away from lead-zinc operations.

U.S. VISITORS at the joint convention of the Prospectors and Developers Association and the Geological and Mineralogical Association of Canada, held at Toronto, included the above group. From left to right: S. K. Garrett, director of exploration, Sunshine Mining Co., Spokane, Wash.; B. L. Murowchick, supervisor of minerology, International Minerals and Chemicals Corp., Mulberry, Fla.; Mrs. Pauline Moyd, consulting geologist, Yonkers, N.Y.; Robert W. Crump, geologist, Jones & Laughlin Steel Corp., Pittsburgh, Pa.; and J. W. Avery, geologist, of Ishpeming, Mich.

Lucky Mc Uranium Corp. and the Atomic Energy Commission signed a contract May 1 extending concentrates

COPPER
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WEMCO World Standards in Mineral Processing...

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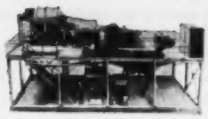
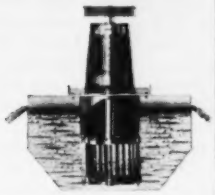
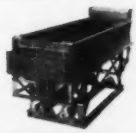
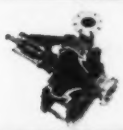
EQUIPMENT		FEATURES	SPECIFICATIONS
	**WEMCO MOBIL-MILL**	Widely used for profitable production of marketable concentrates and low cost elimination of waste in treating metallic minerals, industrial minerals, coal and aggregate. Pre-engineered and pre-fabricated for maximum flexibility. Incorporates Wemco Drum type and Cone type separators for most accurate separations and highest recoveries.	Specific Gravity Range: 1.25 to 3.40 Capacity: 5 to 500 TPH Separatory Vessel: Cone, Single Drum, Double Drum, 2-Compartment Drum.
	**WEMCO FAGERGREN FLOTATION MACHINE**	World standard of flotation in major operations with maximum capacity per cubic foot of floor space. Rotor-stator principle gives optimum pulp circulation and aeration for high metallurgical efficiency. New air control for increased cleaning efficiency. Special feed boxes eliminate costly pumping. Minimum adjustments.	Sizes: 12" to 66" Capacity: 1 to 50,000 TPD Rotor-Stator: Rubber or neoprene covered, stainless or alloy iron. Tank: Steel, wood, stainless, cement or rubber lined.
	WEMCO SPIRAL CLASSIFIER	Slime-sand separations from 28 to 325 mesh. Single, double or triple spirals; tank options from straight side to full flare for desired settling area. Hydraulic lifting device available for starting under load without tank drainage. Sealed bearings, replaceable wearing shoes, continuous welded steel tube shaft assures long life.	Spiral Diameter: 12" to 90" Tank Length: 6' to 48' Raking Capacity: 5 to 24,000 TPD Wearing Parts: Alloy iron stainless steel or rubber covered.
	**WEMCO REMER JIG**	Ideal for concentration of large tonnages of ores where specific gravity differential exists and ratio of concentration is low. Provides exclusive differential acceleration — combined high and low frequency strokes — with live jig bed over entire surface.	Type: 2 hutch, 3 hutch Sizes: 5'x11' to 5'x16' Capacity: 30 TPH to 60 TPH per unit.
	WEMCO AGITATOR-CONDITIONER	For fast, homogeneous agitating, mixing and blending. High intensity Fagergren type mixer-blender for reagents, other material with poor solubility characteristics. Propeller type available for conditioning flotation pulp, reagent mixing or blending. Certain parts interchangeable with Wemco Fagregren Machines. Turbine agitators also available for special applications.	Sizes: High intensity type cell sizes 2 cu. ft. to 100 cu. ft. Propeller type, tank sizes 2' to 20' diameter. Wearing Parts: Alloy iron, stainless rubber or neoprene covered.

WEMCO PUMPS

	WEMCO DIAPHRAGM PUMP	Widely used for handling dense pulp, sludges and other fluids with solids which wear or clog other pumps. Ideal for control of hydroseparator and thickener underflow. Adjustable speed and stroke. Fast takedown and replacement of parts.	Sizes: 2" to 4" Simplex & Duplex Capacity: 5 to 100 GPM Construction: Fine Grained iron, rubber valve seats, stainless steel or rubber covering.
	WEMCO SAND PUMP	Handles pulps of sands, abrasive solids, slimes, slurries and heavy media; pumps flotation feed, concentrates and tailings. Used for HMS circuits, screen products and grinding mill discharge to classifiers. Change of wearing parts made readily.	Sizes: 1¼" to 8" Capacity: 20 GPM to 2200 GPM Discharge Head: Up to 100 Ft. Pulps Handled: Up to 65% solids, particles up to 1"
	WEMCO VERTICAL SAND PUMP	Provides performance of Wemco Sand pumps with added vertical application. Used for clean-up duty installed over sump or on cross members without need for separate dry pump pit. Can be mounted inside flotation concentrate launders for pumping concentrates.	Sizes: 1¼" to 4" Capacity: 20 GPM to 500 GPM Pulps Handled: Up to 65% solids, particles up to ¾"
	**WEMCO TORQUE-FLOW PUMP**	New principle incorporates recessed impeller, continuous open passage. Permits pumping of large solids and tramp material in slurry without clogging. Wear is reduced since only small portion of slurry comes in contact with moving parts. Handles slurries with higher solids content than conventional pumps.	Sizes: 2"x2" and 3"x2" to 8"x8" and 10"x8" Capacity: 50 GPM to 2500 GPM Head: Up to 100 ft. Construction: Ni hard for abrasive service.

WEMCO® **Western Machinery Company** 650 FIFTH STREET • SAN FRANCISCO 7, CALIFORNIA
and throughout the world

WHETHER BIG,

OR VERY SMALL...

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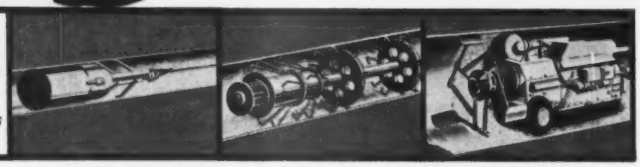
Yes, Sir! Rehabilitation of old, corroded and leaky pipe lines has been our business for many years. We repair pipe interiors with cement mortar lining... all the way up from four inches to as big as 144 inches. And mostly, this rehabilitation is done "in place," underground.

3 processes



THE TATE PROCESS is for pipe diameters from 4" to 16" and is done, "in place," after by-pass lines are set up to carry on with water service.

First, the pipe is scraped and cleaned. Then, cement mortar is fed in and applied under pressure to a compact thickness of 3/16" to 1/4" giving the final effect of one continuous, cement mortar lined tube.

THE SPUNLINE PROCESS is partly TATE and partly centrifugal, developed to provide a thin lining for preventing corrosion and to restore hydraulic flow, particularly in cast iron pipe. The cement mortar lining can go past fittings and openings. It can be applied "in place." Uninterrupted continuity is obtained.

CENTRILINE Centrifugal Process. Cement mortar lining ingredients are mixed to rigid requirements and applied under a high velocity spray with uniform speed. Rotating steel trowels spread the mortar to a smooth, hard finish. Pipe sizes vary from 16" on up to 144". Clay, cement, brick, steel, cast iron and wrought iron pipes may be CENTRILINED.

plus SOMASTIC®

outside pipe coating which may be applied either at the central Wilmington, California, plant, or at railhead plants elsewhere.

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Wyoming *(Continued)*

purchasing at the mining firm's mill in Wyoming's Gas Hills district to Dec. 31, 1966.

Under the contracts signed, Lucky Mc will hike ore runs from presently permissable 833 tpd to 980 tpd.

The mill during second quarter 1958 was run with permission of AEC at rates exceeding 1,000 tpd.

A Commission spokesman said he could offer "no explanation" on why the contracts specified 980 tpd of capacity for ore when the original allocations for the mill made April, 1958 on basis of ore surveys dated Nov. 1, 1957, provided for capacity of 1,002 tpd at Lucky Mc.

The difference is believed accounted in higher grades of ore which Lucky Mc proposed to run as a result of the negotiations with the Federal agency. No major changes will be required in the mill to handle the larger capacities.

Participating in the contract signing were Allen D. Christensen and Tony Mecia, president and vice president respectively of Utah Construction Co., San Francisco, Calif.; A. V. Quine, Lucky Mc General manager; Niel McNiece, Lucky Mc vice president and director who discovered Gas Hills district, both of Riverton; Allan Jones, manager of Grand Junction Operations Office of the Commission. U-C controls 60% of Lucky Mc Uranium Corp.

J. R. Simplot's "Ruby Corp." has moved to take Iron claims in Wyoming's Atlantic City district to patent, it is reported.

The action is seen as a prelude to start in 1960 on U.S. Steel's 50-million open pit mining and beneficiation project in this area. The taconites would go to the Geneva Works near Provo of USS's Columbia-Geneva Steel Division.

U.S. Steel three years ago acquired the rights on the Ruby Corp.'s holdings in the Atlantic City.

Bechtel Corp. is expected to complete its final plans by July for designing a proposed iron ore upgrading plant for the Columbia-Geneva division of U.S. Steel Corp.

Bechtel said plans were about 80% completed in mid-April.

Columbia-Geneva has been conducting extensive tests for the past two years on feasibility of developing the vast low grade taconite deposits near Atlantic City, 25 miles southwest of Lander.

The company has been considering developing the deposits, building an upgrading plant and shipping the ore to its blast furnaces in Provo.

IN CANADA

BRITISH COLUMBIA

Construction of Western Canada's first iron and steel smelter has started at Kimberley, B.C., by Consolidated Mining & Smelting Co. of Canada Ltd. The smelter will be the first stage in an

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Brunner & Lay, Inc., 9300 King St., Franklin Park, Ill.

77 Progressive years. Plants & Conversion Shops: **ALBUQUERQUE**—2224 Broadway S.E. (CHapel 2-2730); **ASHEVILLE**—350 Depot St. (ALpine 3-3681); **BIRMINGHAM**—5—18th St. S.W. (STate 6-6339); **DALLAS**—150 Leslie St. (Riverside 7-0726); **DENVER**—2 Santa Fe Drive (ALpine 5-3948); **DORCHESTER (Boston)**—203 Victory Rd. (AVenue 2-4700); **LOS ANGELES**—2425 E. 37th St. (LUdlow 7-1233); **PHILADELPHIA**—2514 E. Cumberland St. (NEbraska 4-8100); **PORTLAND**—600 N. Tillamook St. (ATlanta 1-0079); **SACRAMENTO**—7500 14th Ave. (GLadstone 7-8522); **SEATTLE**—2600 First Ave. at Vine (MAin 2-8532); **SPOKONE**—5311 E. Railroad Ave. (Yardley) (KEystone 5-6122); **LACHINE, P. Q. Canada**—2280—43rd Ave. (MElrose 1-8588). **VANCOUVER, B. C.**—1230 Seymour St. (MUtual 2-1926.)

Brunner & Lay TUNGSTEN CARBIDE ROK-BITS

FOUR-POINT ROK-BITS

STANDARD STYLE

CUTAWAY STYLE

"X" TYPE (for long hole drilling)

CROSS TYPE (for long hole drilling)

Thread Gauge	A	F	H	D	G	113	121	Type 0	Type 1	Type 11	Type 111	200	400	600	700	J5.23	J7.23 J7.5	1,000	1⅛" Rope	1¾" Rope	2" Rope
1¼"	X					X															
1⅜"		X				X		X													
1½"		X	X			X		X				X									
1⅝"		X	X			X						X									
1¾"			X	X					X			X									
1⅞"			X	X					X			X	√X								
2"			X	X					X	X		X	√X								
2⅛"			X	X								X	*X								
2¼"			X	X			X				X	X	*X								
2⅜"				X			X				X		*X								
2½"				X	*X		X				X		*X	√X					√X		
2⅝"				X			X														
2¾"				X	*X		X				X			√X					√X		
3"				X	*X		X				X			√X	X	X			√X	√X	
3½"														√X	X	X	*X		√X	√X	√X
4"														√X	X	X	*X	*X	√X	√X	√X
4½"																	*X	*X			√X
5"																		*X			√X

*available in X design only √available in X or cross design

CHISEL TYPE

Other threads on special order.

Bit Size	Thread
1⅜"	H
1½"	H
1⅝"	H
1¾"	H
1⅞"	H
2"	H

H also designated as 116H, D as 119D.

If your requirements cannot be met with our standard bits, we will engineer a Rok-Bit for the job.

ROK-MASTER ROK-BIT

For use with "QuarryMaster drill"

Bit Size	Thread
6"	2" x 3"—No. 7 A.P.I. Thread

HOLE-MASTER ROK-BIT

For use with "Down the Hole drill"

6"	Spline
6½"	Spline
7"	Spline

TAPER TYPE

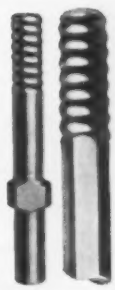
Brass Shim Furnished With Each Bit.

FOR USE ON ⅞" STEEL		FOR USE ON 1" STEEL	
TAPER SPECIFY	BIT SIZE	TAPER SPECIFY	BIT SIZE
A-#7-12°	1¼"	A-#7-12°	1½"
A-#7-12°	1⅜"	A-B-#7-#8-12°	1⅝"
A-#7-12°	1½"	A-B-#7-#8-12°	1¾"

CARBON Hollow Drill Steel*

Steel Section	Shank Size	Length	Steel Section	Shank Size	Length
⅞" Hex.	⅞" x 3¼"	1' thru 20'	1⅛" Rd.	1" x 2¼"	1' thru 20'
⅞" Hex.	⅞" x 4¼"	1' thru 20'	1⅛" Rd.	Lug	4' thru 20'
1" Hex.	1" x 4¼"	1' thru 20'	1¼" Rd.	Lug	4' thru 30'
1" Rd.	⅞" x 4¼"	1' thru 20'	1½" Rd.	Extension	6' thru 40'
1" Rd.	Lug	1' thru 20'	1¾" Rd.	Extension	6' thru 40'
			2" Rd.	Extension	10' thru 30'

*Some sections of the above also available in ALLOY steel, upon request.



INTRA-SET DRILL STEEL

Carbide insert. For secondary drilling, etc.

STEEL SECTIONS	BIT SIZES
⅞" Hex & Q.O.	1" to 1¾"
1" Hex & Q.O.	1⅛" to 2"
1⅛" Round	1¾" thru 2"
1¼" Round	1½" to 2¼"

Lengths up to 12 feet, with shanks to fit any hammer. Available in 1/16" or 1/32" changes. Nothing to lose, bind or stick. Request folder on Mining Intra-Set.

CARBO-ROK Extension Steel

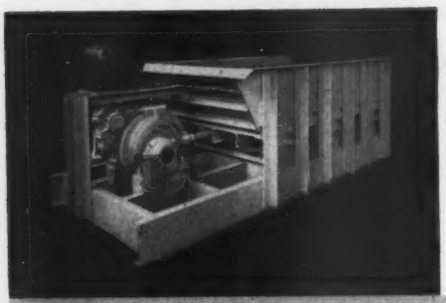
1¼" Hex.—1½" Rope or 600 Thread. Length o/a—2' thru 14'

1½" Hex.—1¾" Rope or 700 Thread. Length o/a—2' thru 14'

Couplings available in all ROPE THREADS; and Brunner & Lay striking bars in all popular sizes, with or without ring seals.

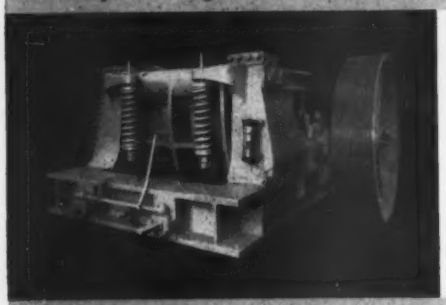
Greatest Economy

for feeding and crushing



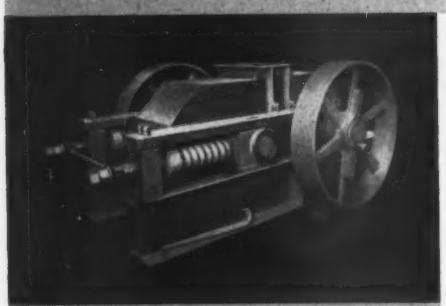
These feed controlled quantities of all materials, from fine sand to shovel-loaded rock —with very low operating costs.
Bulletin FRE-57.

Reciprocating-Plate Feeders



The world's most powerful single roll crushers — outstanding on heaviest duty applications and with wet and sticky feeds.
Bulletin RMTD-56.

Rockmaster Crushers



Great capacity, very low maintenance cost per ton — industry's pace setters for finer reductions of medium sized feeds.
Bulletin DR-256.

Heavy-Duty Double-Roll Crushers

SINCE 1835
McLANAHAN

FEEDERS and CRUSHERS

McLANAHAN & STONE CORPORATION
255 Wall Street • Hollidaysburg, Pennsylvania

B. C. *(Continued)*

integrated iron and steel operation costing in excess of $20-million which will produce pig iron, steel ingots, and rolled steel products, to serve the rapidly growing markets in western Canada. Planned capacity will be in excess of 100,000 tons per year. The smelter will be located adjacent to Cominco's chemical fertilizer plants in Kimberley and will employ over two hundred men. The announcement was made simultaneously April 28, 1959 by the Honorable W. A. C. Bennett, premier of British Columbia, in Victoria, and W. S. Kirkpatrick, president of Cominco, in Montreal.

The first stage will consist of sintering and furnace feed facilities for a capacity of 100,000 tons of steel per year and one electric furnace of designed capacity of 36,500 tons of pig iron per year, with production scheduled for early in 1961. The addition of a second larger furnace and oxygen-blown converters for the production of steel ingots together with fabricating facilities will follow in the very near future, according to the company's plans.

Cominco's large reserves of iron tailings from the Sullivan Mine at Kimberley have long been recognized as the major source of raw material for a primary iron smelter in western Canada. Reserves equivalent to over 15-million tons of recoverable iron have accumulated during the years and current mine production increases these reserves by the equivalent of over 350,000 tons of iron each year. This raw material will be made available to the new project in the form of a high-grade iron oxide containing over 60% Fe. These iron reserves, Cominco's hydro-electric power resources on the Kootenay and Pend-d'Oreille rivers, and the proximity of coal, coke and limestone in the Crowsnest Pass area, constitute a unique combination of the materials needed for the production of iron and steel.

British Columbia Court of Appeal has brought down a unanimous decision that the B.C. government has the authority to levy a tax on iron ore. The ore export trade picture now is extremely uncertain.

The Mineral Property Taxation Act was passed in 1957, imposing a tax on minerals "within, upon or under" land in designated producing areas. In July 1958 British Columbia Supreme Court declared the act ultra vires of the legislature, and in February 1959 Attorney-General Robert Bonner launched an appeal against this judgment.

The iron ore export trade to Japan has expanded into an unofficial $40-to $50-million business with four B. C. companies involved and others pending. Texada Mines Ltd. has shipped more than 1.5-million tons of ore to Germany and Japan since 1952. Empire Development has shipped 300,000 tons to Japan, and have a three-year contract running into an estimated $12-million. Nimpkish Iron Mines Ltd. plans to start shipment of about $10-million worth of ore to Japan this summer, and Pacific Quarries Ltd. and Cascade Lode Mines plan to

ALEMITE PORTABLE SERVICE STATION

is "Open All Night"

to keep your machines on the job All Day Long!

This service station never closes! It goes *anywhere* it's needed—*whenever* it's needed. Provides fast, modern power lubrication for trucks, tractors—*any equipment*—right on the job.

There's no need to lose valuable machine-hours while equipment is being lubricated. No time is spent traveling to and from field grease shops.

Heavy-duty Alemite Portable Service Stations are equipped with lights for around-the-clock, off-shift service. All the advantages of modern power lubrication are brought right to equipment in the field!

Alemite Portable Service Stations
Offer These Four Services

Fast, easy lubrication of track rollers and fittings.

Quick filling of gear housings, transmissions, final drives.

No oil wasted—use exact amount of lubrication required.

Air line equipment for tire inflating, air jet cleaning.

Rugged Alemite Pumps and Hose Reels are mounted on truck beds. They deliver fresh, uncontaminated lubricants direct from "barrel to bearing". . . . give you these three important savings:

1. Save Time! Alemite Portable Power lubrication is 64% faster than hand methods! Lubricates on the job—safely—efficiently—economically!

2. Save Money! By cutting expensive lubrication down-time—increasing output of both men and rigs.

3. Save Equipment! By greatly reducing the possibility of costly, time-consuming bearing failure.

Let an Alemite portable lubrication help keep tight schedules and save money for *you*. Mail coupon for complete information and free illustrated booklet!

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Portable Service Stations

Products of STEWART-WARNER CORPORATION

STEWART SW WARNER

8 reels mounted on back of truck, plus one water hose on each side, allow Portable Service Station to service two machines at once. Equipped with separate power supply, which furnishes lights for night-time service.

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SAUERMAN NEWS briefs

SAUERMAN BROS., INC.,
626 South 28th Avenue, Bellwood, Illinois
Linden 4-4892

Cableway-DragScraper Blends, Reclaims Stockpiled Ore

Over a million tons of iron ore may be stockpiled in the new facilities of a South American mining company. The DragScraper permits better blending of the ore and reclaims all stockpiled material that does not flow by gravity into two 3000-ftph. tunnel conveyors.

The 10-yd. Dragscraper is suspended from a carriage traveling on a track cable between two self-supporting towers. These travel on tracks paralleling the storage area. Despite the size of the Sauerman installation, it may be controlled by one man.

(Condensed from a forthcoming Sauerman News)

Efficient Slag Removal

A 4-yd. Sauerman DragScraper machine is incorporated in the waste slag disposal system of a large copper smelting operation. The slag is flumed into two dewatering tanks separated by a common wall. After a tank is drained, the slag is reclaimed by the DragScraper to a hopper at the head end. The DragScraper is remotely operated from a station above the hoist to provide good visual coverage of the installation.

The monorail-trolley assembly at the tail end provides lateral movement of the DragScraper. The monorail spans the tanks, and a Durolite single block on the trolley carries the backhaul cable. Shifting is handled by a motorized winch remotely controlled by the hoist operator.

The DragScraper reclaims to the hopper at about 250 tph. The hopper, in turn, feeds a conveyor belt which carries slag to the disposal area.

(Condensed from Sauerman News No. 155)

Handling Phosphate Ore

Ore concentrate is stockpiled and reclaimed as required to the foot of a bucket elevator by a Sauerman DragScraper Machine at a Southern chemical plant.

A self-propelled tail tower travels around the perimeter of the stockpile. The tower is shifted to change the line of operation. DragScraper haul length is 400 ft. The operator's station for the Sauerman hoist is located above the conveyors to give a clear view of the pile.

(Condensed from Sauerman News No. 151)

MORE NEWS AND INFORMATION

Issues of Sauerman News giving greater detail about the installations on this page are available on request. For more information on your materials handling requirements, contact Sauerman Bros., Inc., 626 S. 28th Ave., Bellwood, Ill. Linden 4-4892.

B. C. *(Continued)*

develop more than 300,000 tons of high-grade ore for export.

Mines Minister Kenneth Kiernan said in Victoria he presumed the tax would be levied immediately and would apply to all iron ore production from Jan. 1, 1957.

The mining industry is concerned about the more than 20% increase in compensation board assessments for silicosis this year. The increase raises the assessment from $5.63 to $7.00 per $100 of payroll. The matter was aired during the annual report of Cariboo Gold Quartz Mining Co. W. B. Burnett, president, attacked the Workmen's Compensation Board for having "too much arbitrary authority". He said Cariboo Gold had introduced anti-silicosis safety measures before they were required by law, that the mine had never been responsible for a case of silicosis, and yet the company had paid $400,000 to the WCB since 1931.

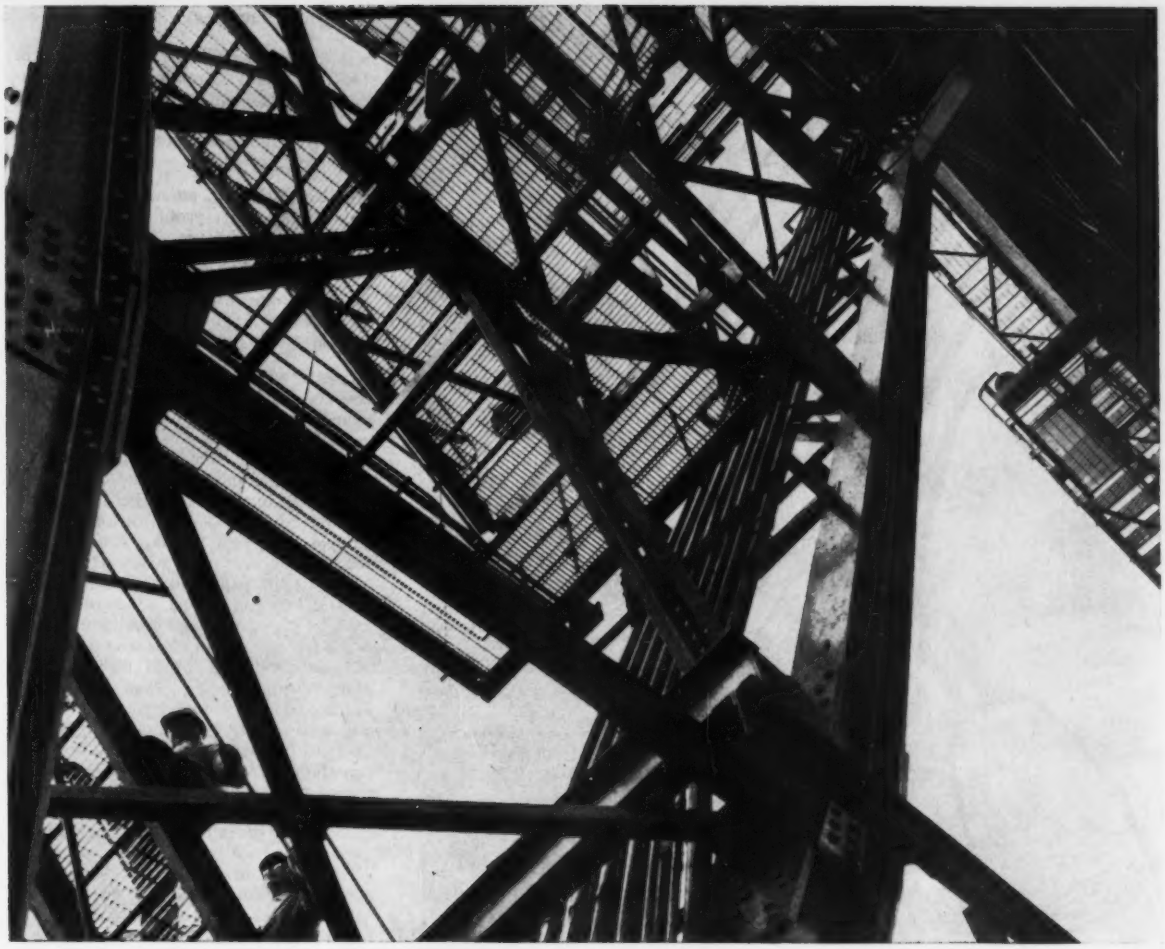
There is not a single case of silicosis in a miner who started work in B.C. after 1942, but today's "clean" mines are paying pensions to silicosis victims of dust-filled mines of years ago. Silicosis pensions were paid to 52 additional miners in 1958 compared to 38 in 1957.

Further steps are being taken by Cowichan Copper Co. Ltd. to implement a $2-million development program for Nadira, Avalin and Caycuse copper prospect companies with properties near Cowichan, and Cellardor, a former producer south of Duncan.

Stockholders authorized directors to acquire shares in the companies all controlled by O. G. MacDonald, Cowichan president. The company plans to use about 500,000 shares of unissued stock to acquire the necessary shares needed to assume control, and use the remaining 500,000 shares to raise about $1-million over two years. Cowichan plans to give the companies financial backing for development, and retain the first rights to their production.

Frobisher Ltd. is considering a plan for export of British Columbia iron ore, according to its annual report. Wesfrob Mines Ltd., an associated company, has blocked out 4.9-million tons of ore grading 57.3% Fe and 0.59% Cu in the Queen Charlotte Islands, but production plans have been held back by the controversial B.C. tax legislation. Several proposals from iron and steel groups in Japan, U.S. and Canada have shown interest in these deposits but the company has reserved its decision. Quebec Metallurgical Industries, another associated company reports that its Wedeene River prospect near Kitimat shows worthwhile concentrating-grade iron and further work will be done there this year.

Granby Mining Co. Ltd. plans to resume drilling on the Babine Lake copper property "in an effort to more accurately estimate its importance," according to L. T. Postle, president. The property is owned by Franisle Copper Ltd. a subsidiary of Granby, and last drilling



For the best in outdoor flooring

Specify BLAW-KNOX Electroforged® Steel Grating and Treads

For safe, all-weather, outdoor flooring, made to take punishment and stand the strain, specify Blaw-Knox Electroforged Steel Grating and Treads. Proven on outdoor installations in all parts of the world, Blaw-Knox grating has an established reputation for quality, durability, and safety.

Easy installation—rigid one-piece construction fits readily around pipes, beams, and equipment.

Maximum load bearing capacity—Electroforging eliminates slotting or otherwise weakening bearing bars . . . one-piece construction increases structural strength.

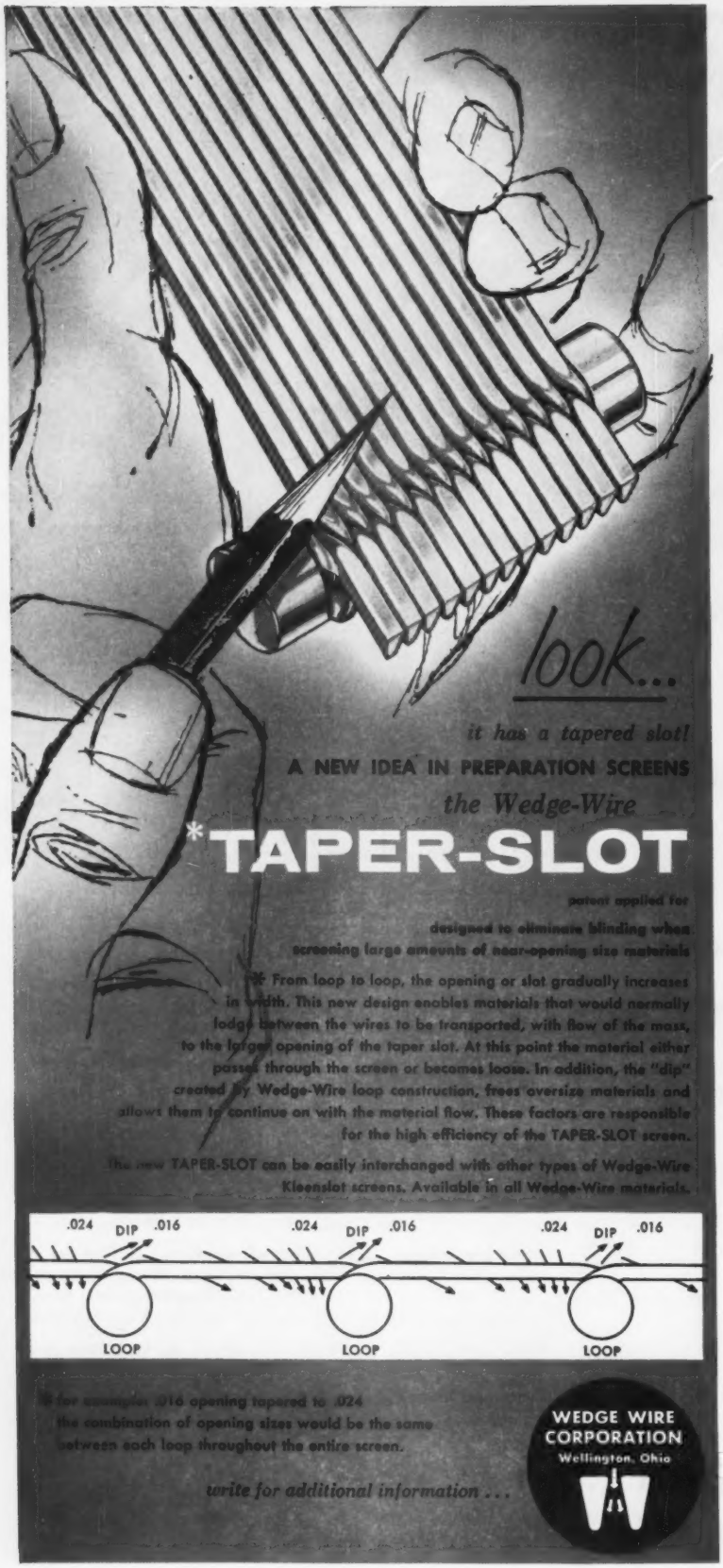
Safest walking surface—non-slip, twisted crossbar plus choice of two types of bearing bars. Square, for smoothest walking surface . . . serrated, for maximum safety under extremely hazardous conditions.

Self-cleaning—Electroforged construction leaves no sharp angles to clog with dirt or grease. Being open, rain water usually provides all the cleaning necessary. Maximum open area allows light for working beneath floor.

Blaw-Knox has the grating and treads best suited to your needs. For information on how to specify and order, send for your copy of Blaw-Knox Bulletin 2527-R.

BLAW-KNOX

BLAW-KNOX COMPANY
Blaw-Knox Equipment Division
Dept. S, Pittsburgh 38, Pennsylvania


look...
it has a tapered slot!
A NEW IDEA IN PREPARATION SCREENS
the Wedge-Wire
*TAPER-SLOT
patent applied for
designed to eliminate blinding when screening large amounts of near-opening size materials
* From loop to loop, the opening or slot gradually increases in width. This new design enables materials that would normally lodge between the wires to be transported, with flow of the mass, to the larger opening of the taper slot. At this point the material either passes through the screen or becomes loose. In addition, the "dip" created by Wedge-Wire loop construction, frees oversize materials and allows them to continue on with the material flow. These factors are responsible for the high efficiency of the TAPER-SLOT screen.
The new TAPER-SLOT can be easily interchanged with other types of Wedge-Wire Kleenslot screens. Available in all Wedge-Wire materials.
.024 DIP .016
.024 DIP .016
.024 DIP .016
LOOP
LOOP
LOOP
For example .016 opening tapered to .024 the combination of opening sizes would be the same between each loop throughout the entire screen.
write for additional information . . .
WEDGE WIRE CORPORATION
Wellington, Ohio

B. C. *(Continued)*

was done in 1956. Last report, made in 1956, was that 22-million tons were indictated averaging 0.56% Cu.

Production has started at the Phoenix plant, capable of handling 750 tpd, Granby reported.

Highland-Bell Ltd. announces in its annual report a net profit of $261,389 in 1958. During the year Beaverdell mine and mill operated at maximum capacity. The company is a shareholder in Mattagami Lake Mines Ltd. and Watson Lake Mines Ltd. through its participation in the Mattagami Syndicate.

A shaft will be sunk by Torwest Resources Ltd. on its Aberdeen property near Merritt, and diamond drilling has extended the main orebody 500 ft in length with an average width of 70 ft. Five crown grant claims and 10 located claims surrounding the Aberdeen property have been acquired from Bethlehem Copper Co. Latest assay results from No. 7 Hole ran 8.67% cu for 62 ft. Hole No. 8 is still drilling in good mineralization and is cutting the ore zone 200 ft west of the previous limitations of the main orebody. No. 5 Hole averaged 10% Cu and 17.9% Fe for 21 ft. Bulk sampling across the ore zone at surface averaged 3.96% Cu from three tons shipped to Vancouver for assays. Eight carloads of high-grade copper ore are ready for shipment from the Aberdeen mine but destination is uncertain due to a labor strike at the Tacoma smelter. Aberdeen shows promise of becoming a medium-sized high-grade copper producer according to Sherwin F. Kelly, consulting geologist. Drilling program on Swakum Mountain, 14 miles north of Nicola is being continued by the company.

Lower prices obtaining for lead and zinc cut into profits of Reeves Macdonald Mines Ltd. despite the fact that more ore was mined and milled in 1958 than in 1957. Total operating cost was reduced although wages and some operating costs were higher. The company shows production of 23,520 oz Ag, 7,973,619 lb Pb, 28,220,124 lb Zn, and 155,937 lb Cd from 417,076 tons of ore mined and milled. Tonnage milled in 1957 was 405,531.

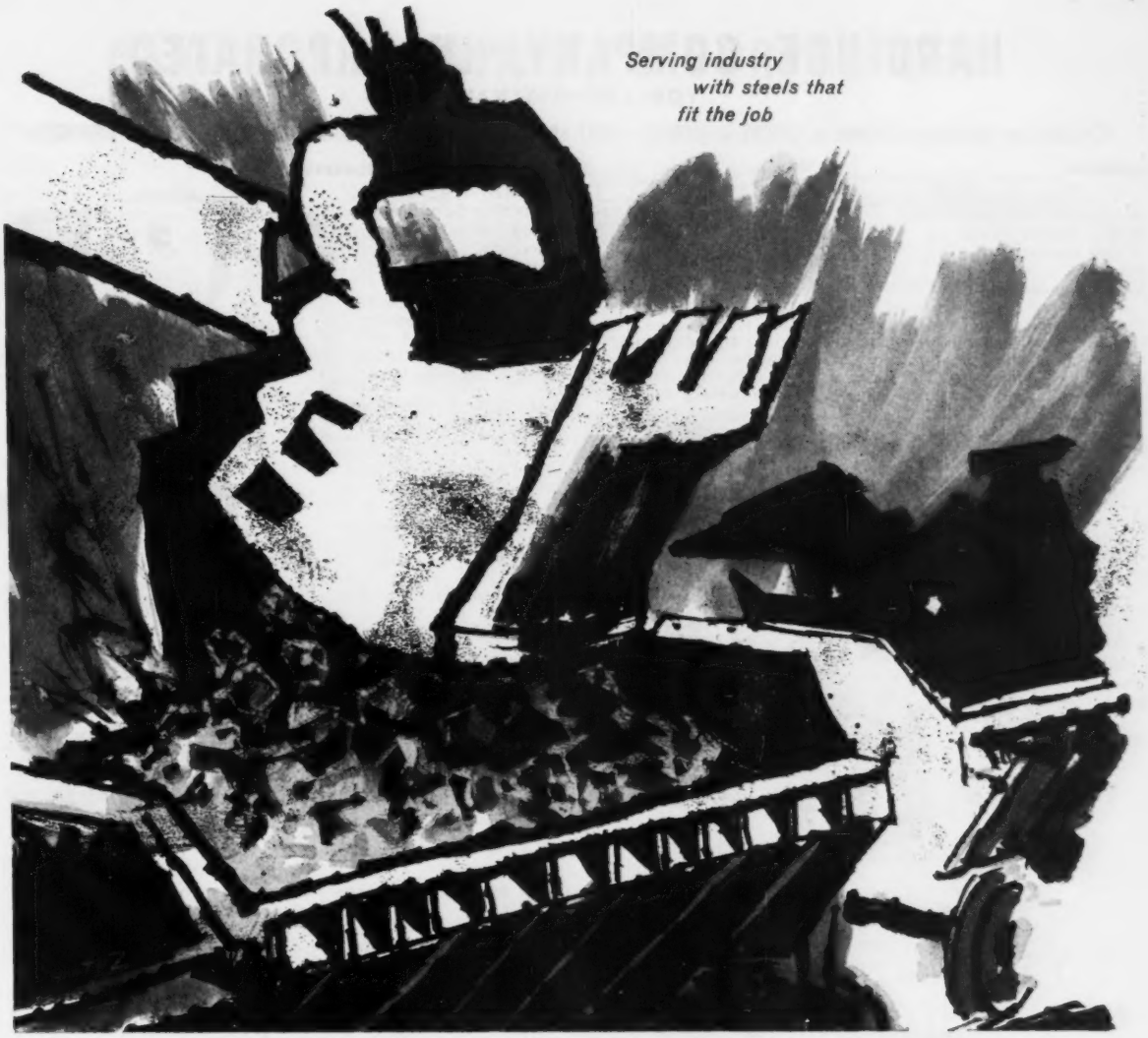
A lone shareholder of Reeves Macdonald launched a fight against an "Americanized" board of directors at the annual meeting. John H. McFayden of Vancouver and president Jens Jensen of Spokane, Washington clashed over the board of directors, which is made up of seven U.S. citizens and two Canadians. McFayden claimed "Americans" had "complete control" of the board. The row started when Jensen asked the meeting to vote the board of directors back into office, which they did despite McFayden's protests.

ALBERTA

A steel mill, said to be biggest in Canada, will be built at Edmonton by Page Hersey Tubes Ltd., and Steel Co. of

HARRISON COMPANY, INCORPORATED

Serving industry with steels that fit the job



GET TOUGH

WITH LUKENS "T-1" STEEL
TRADEMARK

Where the going gets rough, versatile Lukens "T-1" steel fights back. For repair or modification of heavy duty equipment such as truck beds, chutes, bucket teeth and dozer blades, this special duty steel plate can be ordered from *warehouse stock* in a wide range of plate sizes and gages. Lukens "T-1" is the modern mining steel—you can work and weld it in the field as readily as in your shop. Its terrific resistance to abrasive impact—coupled with an extremely high yield strength—means fewer replacements and often greater payloads. That's why more and more equipment builders are using Lukens "T-1" to provide longer life in shovel buckets, trucks and other mining equipment. Remember to specify the extra-tough 321 min. BHN quality. For performance and application details, request our special booklet, "Lukens 'T-1' for Toughness." Address Manager, Application Engineering Dept., M60 Services Bldg., Lukens Steel Company, Coatesville, Pennsylvania.

These warehouses can supply you with Lukens "T-1" steel plate...

Alabama, BIRMINGHAM 2, O'Neal Steel, Inc., P.O. Box 2623 • **California,** LOS ANGELES 54, Earle M. Jorgensen Co., P.O. Box 2358, Terminal Annex, 10650 S. Alameda St. • LOS ANGELES 33, The R. J. M. Company, 238-248 South Mission Rd. • **Illinois,** CHICAGO 8, Joseph T. Ryerson & Son, Inc., 16th and Rockwell Sts. • **Kentucky,** ASHLAND, Mansbach Steel Co., 19th St. and River Front • **Maryland,** BALTIMORE 2, Wm. G. Wetherall, Inc. 317 President St. • **New Mexico,** ALBUQUERQUE, Miller and Smith Mfg. Co., Inc., 500 Phoenix Ave., N. W. • **Ohio,** CLEVELAND 6, Mills-Wolf Steel Co., 12434 Cedar Rd. • **Oregon,** PORTLAND 4, J. E. Haseltine & Co., 115 S. W. Second Ave. • **Pennsylvania,** McKEES ROCKS, Follansbee Metals Division, 200 Bradley St. • **Quebec,** MONTREAL, Drummond, McCall & Co., Ltd., 930 Wellington St. • **Washington,** SEATTLE 4, Stack Steel & Supply Co., 500 Landers St. • SPOKANE 10, Union Iron Works, East 217 Montgomery Ave., P.O. Box 2135.

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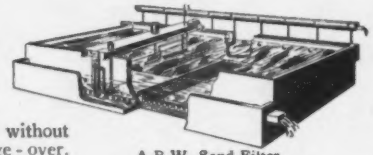
FILTERING

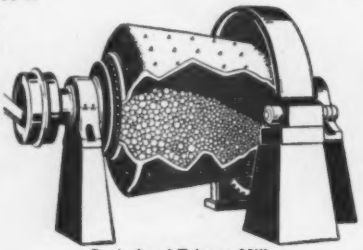


A.B.W. Sand Filter

The Hardinge Automatic Backwash Rapid Sand Filter cleans its own filter bed, a section at a time, automatically, without shut-down or change-over. Primarily adapted to the filtering of water containing small amounts of suspended particles that cannot be properly collected in settling basins or clarifiers. Used for filtering municipal water supplies, industrial water supplies, and certain presettled industrial waste waters to permit their re-use. Bulletin 46-A-1.

GRINDING—PULVERIZING

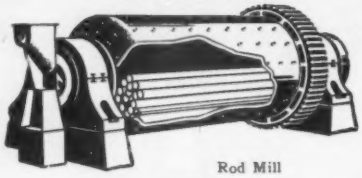
Conical Mills



Conical and Tricone Mills

The shape of the Hardinge Conical Mill causes a rapid circulating and classifiying action within the drum, maintaining the large balls at the feed end of the mill for maximum grinding efficiency. Dry grinding applications — Bulletin 17-C-1; Wet grinding—Bulletin AH-389-1.

Tricone Mills



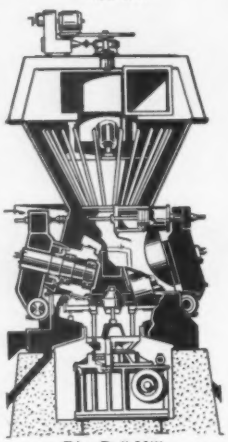
Rod Mill

Built on the same principle as the Conical Mill, the Tricone Mill offers greater grinding volume for a given amount of floor space than any other tumbling mill built. Extremely efficient. Ideal for large tonnages. Sizes up to 12 ft. diameter. Bulletin AH-414-1.

Rod Mills

Steel rods are employed as grinding media. Ideal for producing minimum oversize in open circuit grinding. Conical heads reduce friction, prevent congestion of charge at the ends, and align the rods. Available with either end, or center, peripheral discharge, as well as trunnion overflow. Bulletin 25-C-1.

Disc Roll Mills

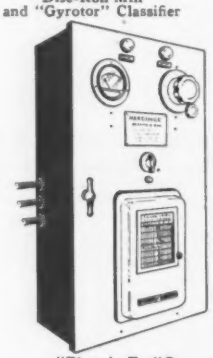


Disc-Roll Mill and "Gyrotor" Classifier

An adaptation of the German "Loesche Mill." A roller-mill with rotating grinding table and pneumatically-loaded rolls for complete flexibility of operation. The "Gyrotor" Classifier, combined with the Disc Roll Mill, provides a highly-efficient dry-grinding device, ideal for relatively soft minerals. Bulletin 52-1.

GRINDING CONTROL

"Electric Ear"®



"Electric Ear"®

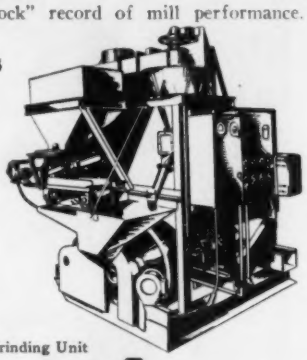
A revolutionary principle of control that automatically regulates the feed rate of a mill to keep it operating at maximum efficiency by "listening" to the sound. Mill capacity is increased 10% to 20%. Now available with built-in, continuous sound-recording charts. Bulletin 42-A-1.

GRINDING SOUND RECORDER

Portable Sound Recorder

The Hardinge Portable Sound Recorder can be used in checking the efficiency of grinding mill operation. It may also supplement existing "Electric Ear" installations by maintaining an "around-the-clock" record of mill performance. Bulletin AH-480-1.

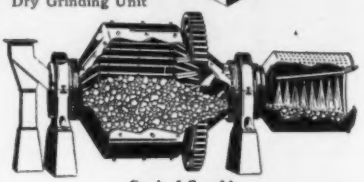
LABORATORY GRINDING UNITS



Dry Grinding Unit

For any small-scale continuous grinding operation, either wet or dry, Hardinge offers a completely self-contained and portable unit which provides all the functions of feeding, grinding, and classifying found in a large-scale system. Complete controls and wiring provided. Just "plug it in." Bulletin AH-448-1.

SCRUBBING

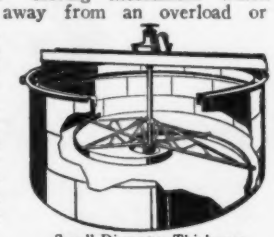


Conical Scrubber

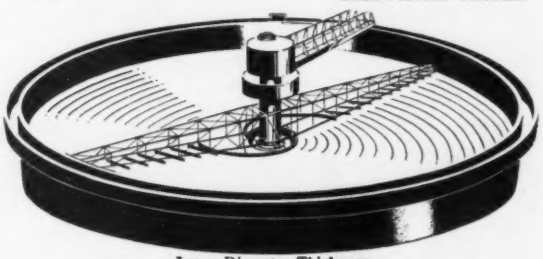
The Hardinge Conical Scrubber cleans by mass contact and natural displacement. This action removes dirt and silt without wear on the scrubber. The classifying action of the cone holds back the large clay balls until properly disintegrated. Foreign materials, such as sticks, vegetation or large pieces of metal, can do no harm. Power required is low, and water requirements are considerably less than that of other methods. Repair costs are negligible. Bulletin 37-B-1.

THICKENING

The distinctive features of the **Hardinge Thickener** are the spiral scrapers, which clean the bottom of the tank with each revolution, and the "Auto-Raise" driving mechanism which automatically lifts the scrapers away from an overload or obstruction in the tank bottom, thus eliminating costly breakdowns and delays. Can be operated very slowly, causing a minimum of disturbance. Produces a clearer overflow and a thicker discharge than other types. Small thickener mechanisms are supported on beams, spanning the tank. The large units carry the mechanisms on a central concrete pier. Bulletin 31-E-1.



Small-Diameter Thickener



Large-Diameter Thickener

LOCAL OFFICE PHONES: YORK, PENNA.—YORK 33-821; NEW YORK — OXford 7-3590; TORONTO — EMpire 3-5692; CHICAGO — FRanklin 2-4182; HIBBING, MINN.—AMhurst 2-2825; HOUSTON—JAckson 3-1733; SALT LAKE CITY—HUnter 4-5151; SAN FRANCISCO —YUkon 2-6920; JACKSONVILLE BEACH, FLA.—CHerry 9-2417; BIRMINGHAM—ALpine 1-9262.

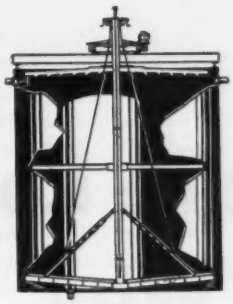
HARDINGE COMPANY, INCORPORATED

YORK, PENNSYLVANIA

NEW YORK • TORONTO • CHICAGO • HIBBING • HOUSTON • SALT LAKE CITY • SAN FRANCISCO • JACKSONVILLE BEACH • BIRMINGHAM

AGITATING

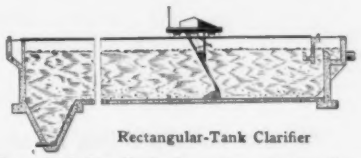
Hardinge combined mechanical and air Agitators are used to mix, agitate or store clay slurries, as well as metallurgical and chemical pulps. Compressed air is delivered to the bottom of the torque tube (which acts as an air lift) and to various points near the ends of the rotating scrapers. Pulp is fed and withdrawn continuously or intermittently, as desired. The drive mechanism is supported on ball bearings in an oil-filled, totally enclosed housing. The scraper raising winch is in easy reach and away from possible splash of pulp. Bulletin 31-E-1.



Agitator

CLARIFYING

For industrial water supply or liquid waste treatment, Hardinge offers clarifiers for both circular and rectangular tanks. The rectangular tank unit is especially suited for limited spaces. A traveling scraper and skimmer carriage travels the length of the tank, running on rails mounted on both sides. Cost of the mechanism does not increase with tank length. Circular-tank units are also available for continuous removal of settling-tank solids, similar in construction to the Hardinge Thickener, (see next page) Bulletin 35-D-1.

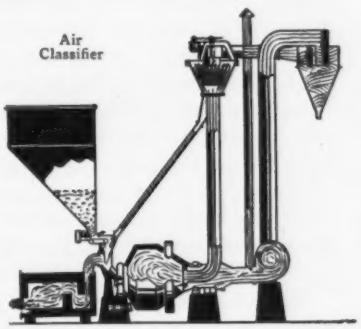


Rectangular-Tank Clarifier

CLASSIFYING • SEPARATING

Dry Classifiers

The Hardinge "Gyrotor Air Classifier, operating in conjunction with the Hardinge Mill, is a compact, self-contained unit of unusual efficiency. The material is conveyed without auxiliary apparatus to any convenient location in the building. The Hardinge "Gryrotor" Air Classifier provides extremely close product control. Bulletin 17-C-1.



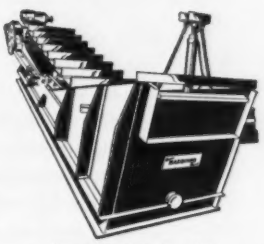
Air Classifier

Wet Classifiers

The Hardinge Hydro-Classifier is a large-volume classifier for fine separating problems. Bulletin 39-C-1.

Hydro-Classifier

The "Overdrain" Classifier is a completely new device. A belt, with lifting flights attached beneath, moves upwardly out of the sand bed between two stationary side shrouds, creating the effect of a series of moving, closed, washing compartments. The only outlet from these compartments is via holes in the belt above. Surplus liquid and slimes discharge through these "overdrain" holes without mixing with the oncoming sands. Extremely clean sand discharge, excellent de-sliming — an ideal washing device. Bulletin AH-478-1.



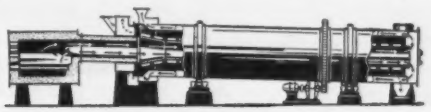
"Overdrain" Classifier

COOLING

Ruggles-Coles Rotary Coolers are employed for cooling hot materials after high temperature drying or calcination. There are four types: the gas-cooled type, the water-cooled shell type, the internal water-tube type, and the direct-contact water type. Bulletin 16-D-1.

Rotary Cooler

DRYING



Class XB Double-Shell Rotary Dryer

There are six different types of Ruggles-Coles double and single-shell continuous Rotary Dryers, designed for direct, indirect and steam heat. Bulletin 16-D-1.

Class XA—This double-shell, semi-direct-heat dryer has the highest thermal efficiency and lowest fuel consumption of any rotary dryer manufactured. Particularly adapted for coal drying.

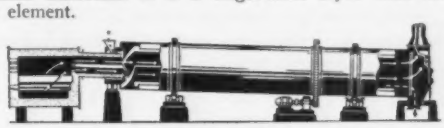
Class XB—A double-shell, indirect-heat dryer designed to handle such materials as Kaolin, chalk, whiting, china clay, pigments, fuller's earth.

Class XC—A rotary steam tube dryer for drying materials that are injured by high temperature such as brewer's grain, cotton seed, starch feed, tobacco stems and corn germs.

Class XF—Single-Shell, counter-flow dryer for high drying temperatures.

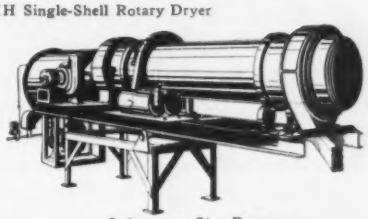
Class XH—A single-shell, parallel-flow dryer, especially designed to handle flotation concentrates without sticking and without excessive dust loss.

Class XW —Used almost exclusively for drying inorganic salts and similar materials. It is a single-shell dryer with steam coil heating element.



Class XH Single-Shell Rotary Dryer

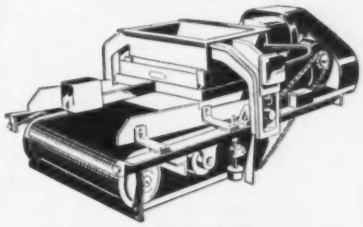
For pilot-plant or laboratory drying operations, Hardinge offers three styles of small, self-contained units, the XH-XF unit, the XB and the XC units.



Laboratory Size Dryer

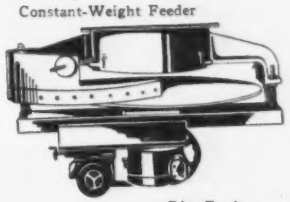
FEEDING

The Hardinge Constant-Weight Feeder measures by weight, not volume, thus compensating for variations due to changes in specific gravity, bulking or size of material. The feeder is quite accurate, and it affords automatic feed control for crushers, pulverizers, mixers, dryers, kilns, furnaces and conveyors. The feeder is bin-supported, requires little headroom. Bulletin 33-E-1.



Constant-Weight Feeder

The Hardinge Disc Feeder is outstanding in its simplicity, sturdiness and ease in adjustment. Particularly suitable for handling bulky, sticky, hot materials. Bulletin 33-E-1.



Disc Feeder

A MESSAGE TO AMERICAN INDUSTRY • ONE OF A SERIES

One Battle We're Losing —And Why

Lest it seem self-serving, we of McGraw-Hill, as publishers, have hesitated to make the following statement about the "Battle of the Books." However, our reticence has been overcome by our conviction that it is greatly in the national interest to have much wider public understanding of the nature of this battle. This conviction is strengthened by the fact that many, not in the publishing industry, believe in the importance of this battle and, further, by the fact that it is a battle which the United States is losing.

The United States is losing an important battle — a battle of knowledge and ideas, waged with books. It does not have the excitement of competition in scientific achievement, nor the urgency of a diplomatic crisis, nor the obvious economic significance of a struggle for export markets. But our success or failure in this battle of knowledge and ideas may well have a decisive bearing on these more spectacular aspects of international rivalry.

The Russians know this. About a decade ago, they started a program to build up their export of books, the most durable and penetrating way of communicating knowledge and ideas. **By 1957 the Soviet Union was exporting 30 million books, one-and-a half times as many as the United States.** Many of these books are printed in English, and all are in languages of the non-Communist world.

In the languages of the Near East alone, the Russians printed and distributed 413,600 books in 1957, as compared with 166,415 in 1956. In India, Russian textbooks on engineering are to be published in English under a technical aid agreement signed in Moscow last December.

"Trade Follows The Book"

Books are in the advance guard of the Soviet political and economic challenge to the free world. With books go ways of thinking — about government, about education, about management, about science and technology. If these books do their job effectively in the training of those who will become a nation's leaders, they will provide the basis for political and cultural understanding and also, in the future, for trade.

The Russians are not the first to discover this relationship. Britain, which lives by trade, has traditionally exported more of its book production than any other nation. Today it exports one book in every two produced. The British have a favorite dictum: "Trade follows the book." They have proved its accuracy. Now the Russians are trying to make this same principle serve their purposes.

Where does the United States stand in this competition for men's minds? In number of books, it trails far behind the Soviet Union — exporting roughly 20 million books, against the Russians' 30 million. As a proportion of our total output of books, our exports amount to only 10% — against Britain's 50%.

The Russians' Advantage

U.S. book exports have grown in the years since World War II, from approximately $11,000,000 in 1946 to $35,000,000 in 1958 (both figures excluding Canada). But in expanding book exports, the American publishing industry faces two major obstacles:

(1) **The comparatively high cost of producing a book in the United States,** which puts its price well beyond the reach of many students, teachers and businessmen in other countries; and

(2) **The shortage of dollar exchange in many countries,** which means that importers can pay for

books only in currencies that are of little use to American publishers.

The Russians have neither of these problems. Soviet publishing is state-subsidized, and exported books are sold for nominal sums paid in the currencies of the importers. As these books serve the political and economic purposes of the Soviet Union, they are cheerfully sold on giveaway terms.

The American publishing industry, on its own, is making vigorous efforts to increase the distribution of American books in other countries. Leading U.S. publishers and their agents have offices and salesmen in the major countries of Asia, Africa and Latin America. Several publishers have begun to reprint textbooks in Asia at one-half to one-third of their U.S. costs, thus making them available to the students in Asian countries at prices they can more nearly afford. And the American paperback has become a symbol of low cost in popular books. But neither of these devices is practicable for serious cultural, technical, scientific, educational and professional books, which require durable, hard-bound and necessarily expensive editions. Despite their great importance to those who need these books, the demand for them is simply not large enough to warrant low-cost publishing methods.

Government agencies also have increased the availability of American books. The United States Information Agency and the International Cooperation Administration have placed American books in libraries overseas, donated them to educational institutions and presented them to key individuals in the industries and governments of the developing countries of the world. But these programs are small in relation to the need.

A Modest Program

An unusual and little-publicized Government program has helped American publishers overcome the other major obstacle to the export of books — the shortage of dollar exchange. This is the Informational Media Guaranty (IMG) program, administered by the United States Information Agency. It enables publishers of books judged to be worthy of the American way of life to sell their books, for local currency, in countries such as the Philippines, Formosa, Vietnam, Burma, Indonesia, Pakistan, Turkey, Israel, Poland, Yugoslavia, Spain and Chile, which would otherwise be unable to buy these books because of their shortage of U.S. dollar exchange.

The IMG program is not a giveaway. Publishers have to **sell** their books, and customers overseas have to want them enough to **buy** them at full prices. IMG merely guarantees that the exporting publisher receives in dollars the payments he collects from his customers in their currency. The program costs very little in terms of our total foreign aid program, or in terms of what it accomplishes. In ten years it has made possible the sale of $150 million worth of books, magazines and films to countries of key economic and strategic importance at a cost of only $10 million.

The IMG functions through a revolving fund. Foreign currencies are exchanged for dollars, and the foreign currencies in turn are resold to replenish the supply of dollars. The net cost is the small but unavoidable loss on resale of these foreign currencies. Over the ten years of this program, the IMG revolving fund has shrunk from its original $28 million to $18 million, $10 million of which is in unconverted foreign currencies.

If this modest but vitally important program is to be continued, Congress must appropriate the money necessary to rebuild the revolving fund. This would ensure that any country approved by the State Department and willing to sign an agreement to buy American books, at their full price, with its own currency, could do so. Last August, Congress reduced a requested appropriation for this purpose from $7 million to $2½ million. To continue even at its present reduced level, an appropriation of $3½ million is needed. To realize the full potential of IMG, the revolving fund must be restored to its original level.

If the IMG program is not continued, with adequate financial support, some countries whose friendship and understanding we seek today and with whom we hope to build a trading partnership in the future will have to reduce their purchases of American books to a trickle. These are countries where school teachers, college professors, students, engineers, doctors and businessmen need and want to buy American books. The loss will be not only theirs, but ours as well. For it will deprive the U.S. of one of its most effective, and least costly, means of communicating knowledge and ideas and understanding of the American way of life.

This message is presented by the McGraw-Hill Publishing Company to help increase public knowledge and understanding of an important national problem. Permission is freely extended to newspapers, groups or individuals to quote or reprint all or parts of the text.

Donald C. McGraw

PRESIDENT

McGRAW-HILL PUBLISHING COMPANY, INC.

BIG·NEW...

Exclusive "Balanced-Design"

This new H-120 "PAYLOADER" tractor-shovel is the result of years of development by The Frank G. Hough Co., combining the experience and "know-how" of the pioneer and leader in this field. HOUGH "balanced-design" provides proper weight distribution; ample power for both drive and hydraulic operations and maximum reach and dumping heights consistent with the handling of bigger, heavier loads.

Safety and Stability Emphasized

The new boom arm design and positioning insures complete operator safety since all moving parts and pivot points are located forward of the operator's compartment. The stability of this new H-120 "PAYLOADER" is helped by the use of special high strength, light weight "T-1" alloy steel in the boom arms. Capacity loads can be carried close to the machine with a 40° bucket tipback at ground level and a flat 75° position at average carry height.

Ease of Operation

With power steering, power air brakes and power-shift transmission, this big tractor-shovel operates easier than many smaller units.

The operator compartment features a canopy, front and rear windshields and windshield wiper. The bucket-type seat is positioned to give unlimited visibility of the load at all stages of operation.

Sensible Service Accessibility

Easily removed panels expose electrical connections and batteries on one side — give access to hydraulic system controls and reservoir on the other. Daily or periodic checking and servicing points are easy to reach.

Two-Stage, Dry-Type Air Cleaner

An important engine protective feature of the new H-120 is the Donaldson "Donaclone" two-stage, cyclonic precleaner and filter air cleaner. It keeps out 99.8% of the dirt — maintains high efficiency regardless of engine speed, temperature changes or dust accumulation, requires 75% less service time.

Power and Efficiency

The H-120 is powered by a CUMMINS NRT-6BI turbo-charged diesel engine developing 300 H.P. at 2,100 rpm. It handles full load of both torque-converter and hydraulic pumps without "lugging down".

The power-shift transmission has four speed ranges in both directions including travel speed up to 28 mph. Exclusive dual brake controls give driver the choice of braking with or without transmission engaged.

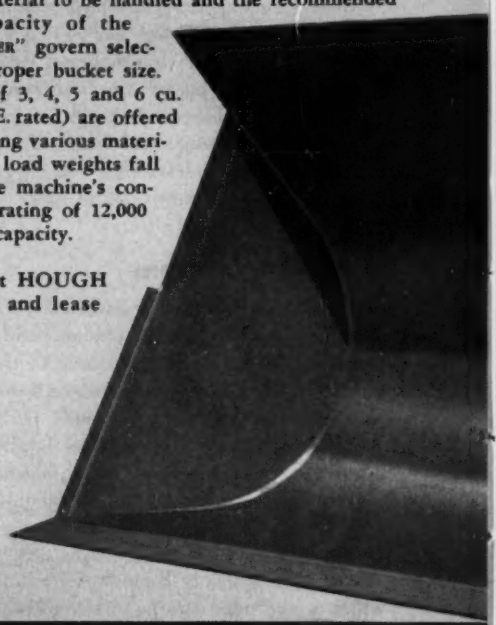
More Reach and Dumping Height

At maximum dumping height this new "PAYLOADER" has 14'6" clearance to the hinge pin and 10'10" clearance with the bucket dumped at 50° angle. In this position the reach from the front tires is 42".

Bucket and Carry Capacity

For continuous operation without abuse, the weight of the material to be handled and the recommended carry capacity of the "PAYLOADER" govern selection of proper bucket size. Buckets of 3, 4, 5 and 6 cu. yds. (S.A.E. rated) are offered for handling various materials where load weights fall within the machine's conservative rating of 12,000 lb. carry capacity.

Ask about HOUGH purchase and lease plans.



THE FRANK G. HOUGH CO. 5-B-1
726 Sunnyside Ave., Libertyville, Ill.
Send complete data on the big new model H-120.

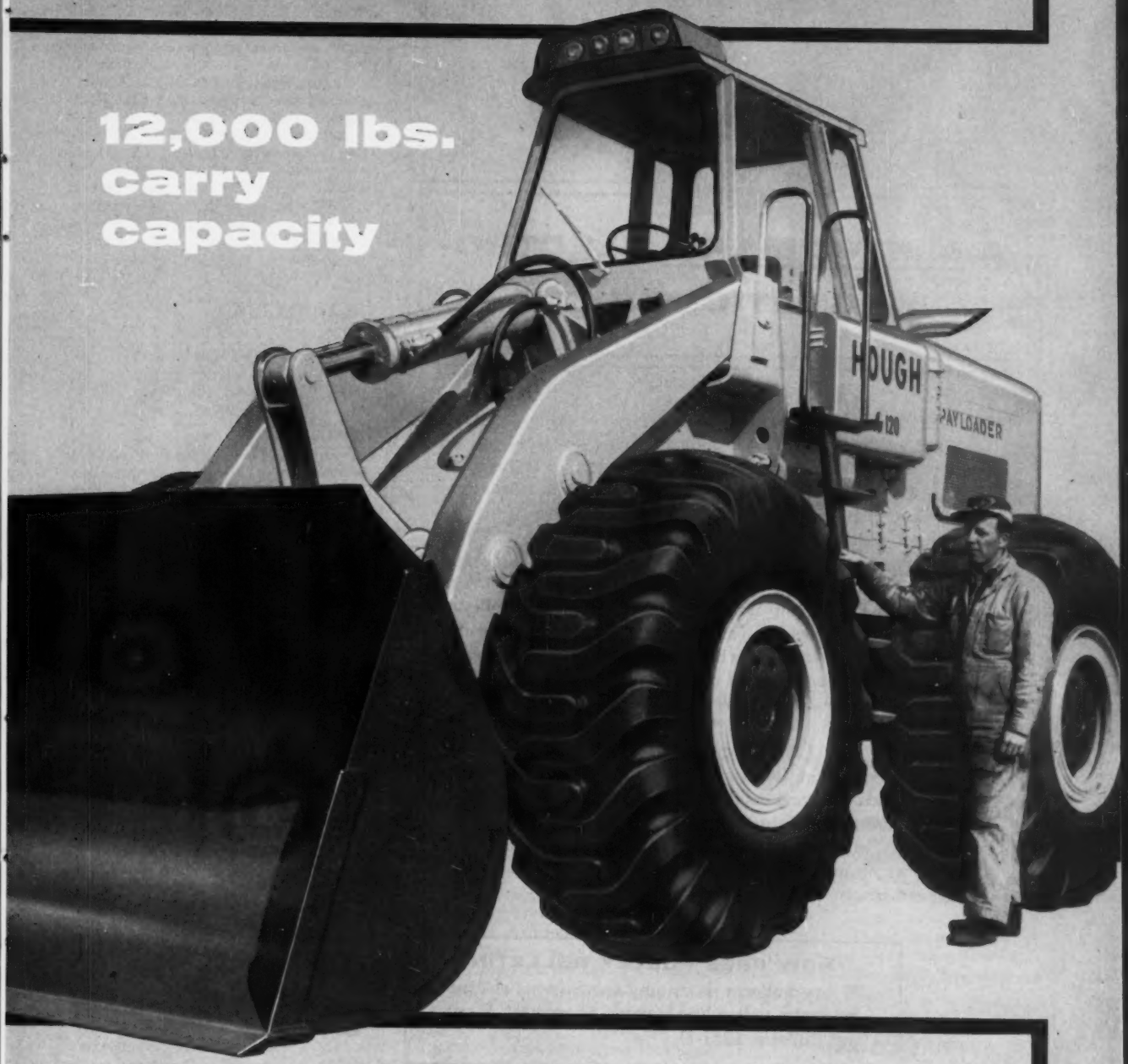
Name
Title
Company
Street
City State

HOUGH®

THE FRANK G. HOUGH CO.
LIBERTYVILLE, ILLINOIS
SUBSIDIARY — INTERNATIONAL HARVESTER COMPANY

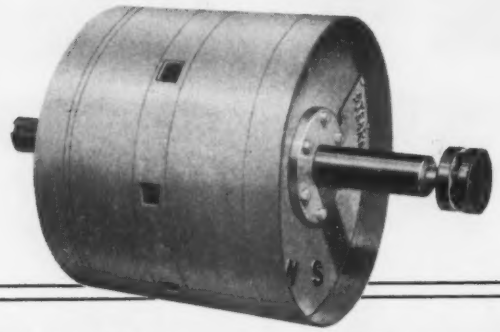
...MODEL H-120

12,000 lbs.
carry
capacity



PAYLOADER®

For Tramp Iron Removal or Cobbing Magnetic Ore



A MINING MAN'S ELECTRO-MAGNETIC PULLEY

Stearns electromagnetic pulleys are engineered to the exacting demands of the most critical mining man. Size for size, Stearns pulleys are the most powerful in the industry; they're rugged; they're top quality in every respect. By reputation, these are the finest electromagnetic pulleys you can use — and over the long pull, the lowest cost.

2-Coil for Tramp Iron

For most effective tramp iron removal, Stearns 2-coil pulleys produce a magnetic field that's deepest at the center of the conveyor belt — where the load is heaviest. Actually, smaller, lower cost 2-coil pulleys can be used on many jobs without changing standard conveyor practices for belt speed, loading, etc.

Multi-Coil for Cobbing Magnetic Ore

For ore concentration, Stearns multiple coil pulleys produce a magnetic field of uniform depth that conforms to conveyor loads on such operations. Stearns' experienced magnet engineers will work closely with you on selecting pulleys for mining applications — or on any other of the complete range of magnetic equipment Stearns builds for the mining industry.

NEW FREE PULLEY BULLETIN

A new bulletin describing the Stearns electromagnetic pulley line is yours on request. Write for Bulletin 1011-D.

STEARNS MAGNETIC PRODUCTS

A DIVISION OF THE INDIANA STEEL PRODUCTS COMPANY

635 SOUTH 28TH STREET • MILWAUKEE 46, WISCONSIN

Alberta *(Continued)*

Canada Ltd., joint announcement stated new mill will be capable of producing steel pipe from 16- to 42-in. outside dia and will be built at cost up to $10-million.

An exploration program in areas east and north of Great Bear Lake will be undertaken this summer by Eldorado Mining & Refining Ltd. W. M. Gilchrist, of Ottawa, president of the Crown company, said in making this disclosure that the program will cost approximately $250,000. Operations of the Port Radium uranium mine at Great Bear Lake, commented Gilchrist, are going smoothly.

Another project planned by Eldorado this year calls for power plant expansion at an estimated cost of $550,000 to serve Eldorado's uranium mine and mill at Beaverlodge, Sask. Under this program, the 3,300-hp hydroelectric plant at Wellington Lake, 35 miles west of Beaverlodge, will be doubled in capacity.

MANITOBA

Montgary Explorations plans to reopen its Bernic Lake lithium mine as soon as possible. Contracts for direct shipping ore have been made with U.S. and German interests.

San Antonio Gold Mines Ltd. reports it will proceed with the development of a deep orebody on the adjoining property of its subsidiary Forty-Four Mines. The new development calls for sinking a new winze 1,000 ft below the 26th level and the opening up of at least six new levels. Funds are to be provided by new financing in which San Antonio will take down unissued shares remaining in the Forty-Four treasury. Forty-Four shareholders are being asked to increase that company's capitalization to four million shares.

Lacwin Mining Co. has completed ten diamond drill holes on its widespread properties on Lake Winnipeg. The company holds 21 groups of claims retained from its original 200,000 acre reservation. The drilling program is being carried out to investigate geophysical survey results. The company was formed to investigate structure believed favorable for base metal deposition which parallels the shore of Lake Winnipeg. Further work is planned for this summer and next winter. Low grade nickel assays were obtained from drill core sections in the vicinity of Pipestone Island and Black Island.

ONTARIO

At Caland Ore Co.'s (Inland Steel) iron ore lease on Falls Bay of Steep Rock Lake near Atikokan, Ontario, a 115-ft headframe and shop building are under construction. The shaft for future underground mining has been sunk to 1,333 ft, and sumps, pumping stations and pockets have been cut. A pumping capacity

Fast Dispersal in 11-ft-dia., 12-ft-deep precipitation tanks is gained by using LIGHTNIN Mixers. For mixer details, request Catalog B-102.

Bicroft Uranium Mines Ltd., Bancroft, Ont.

How **uranium extraction** *gets a helping hand with mixing like this on the job*

In the precipitation tanks at this mine, fluid mixing has to walk a very narrow fence.

It must disperse alkali quickly through the ore, for uniform pH.

But it must also be gentle enough not to break down the delicate uranium oxide floc into a powder that could clog filters, cause stoppages and lower the efficiency of the entire extraction process.

The mixer you see here is one of several installed after a LIGHTNIN Mixer representative asked questions, took samples, and later returned with recommendations based on actual tests run in the laboratory. These LIGHTNIN Mixers are scale-ups of the mixers that solved the problem in the lab. They provide *precisely the balance of horsepower, speed and mixing action* to meet the critical requirements of the process.

Floc stays filterable. And pH quickly arrives at its desired uniformity.

Easy To Install

Installing these units was simple, because all LIGHTNIN Mixers are shipped fully assembled, factory-aligned, ready to install. Standard interchangeable components and easy access to all parts make maintenance easy. Aside from ordinary servicing, these mixers *have required no repairs or attention since going on the job 2½ years ago!*

Results Guaranteed

LIGHTNIN Mixers have many uses that can pay off for you. This mine also uses them to mix the magnesia slurry that controls pH when added to the precipitation tanks, and in making up barren eluate. You can also use them to blend ores in pulp form, speed chemical reactions, condition feed for flotation cells, or solve other fluid-mixing problems. Sizes range from ¼ to 500 HP, and *results are fully predictable, unconditionally guaranteed.*

There's a skilled LIGHTNIN Mixer representative not far from you. Look him up in Thomas' Register—or write directly to us.

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CUSTOM TREATED FILTER CLOTH FOR LONGER LIFE

Every NFM FILTER CLOTH gets a treatment specifically designed to withstand the conditions it will meet on the job. Our cottons are specially impregnated to resist *acids* and *alkalies*. We treat our glass fabrics with silicones and Teflon for *abrasion* resistance. Our cottons and synthetics get the full treatment for *stability:* cold water shrinkage, hot water shrinkage, and heat setting. Nylon gets a dose of neoprene and Hypalon; glass fibres take vinyl shots for their health.

The longer the life — the lower the cost

Service life is the true measure of filter cloth economy. By selecting from the many NFM FABRICS the one that is *custom treated* to last longer in *your* filtration process, you save most where the costs are highest: by reducing down-time, change-over labor, and replacement. When the problem is tough, call the doctor for the NFM ECONOMY TREATMENT.

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Tell us your application, we will send you samples

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Houston, Texas: 1607 Jefferson Avenue
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Ontario *(Continued)*

equivalent to 5,000 gpm has been installed. Inland expects shipments from the property in 1960.

Additions to present contracts of Algom Uranium Mines Ltd. and Pronto Uranium Mines Ltd. for sales of uranium precipitates to Eldorado Mining & Refining Ltd. were announced in Elliot Lake by the Robert H. Winters, president of Rio Tinto Mining Co. of Canada Ltd.

Existing contracts will be completed about December, 1960 for Pronto, and September, 1961 in the case of Algom. The newly approved additions, which have been under negotiation for some time, will enable these companies to produce at their current rates until March 31st, 1962.

The agreement in the case of Algom will mean delivery of approximately 2.5-million lb of uranium oxide, valued at $20-millions. Pronto will deliver an additional 1.5-million lb valued at $12-millions. The price per pound under the terms of the additional contracts is $8. There are no labor escalation factors in this price. At present rates of amortization, the plants will be fully written off over the life of the existing contracts and before the $8 price goes into effect. In both cases, the contracts covering the additions include agreements giving Eldorado options on the output of the mines up to December 31st, 1966.

QUEBEC

A gradual improvement in current business is seen by Aluminium Ltd., but the outlook is for lower tonnage sales and earnings in 1959 than in 1958, Mr. Nathanael V. Davis, president, told the annual meeting of shareholders. Mr. Davis said there have been continuing increases in sales to fabricators and non-producers of primary aluminum, but the "sharp drop in sales to producers" has been fully reflected in the first quarter results which showed net income of $2.3-million as compared to $5.3-million in the first quarter of 1958. The tonnage of metal sold in the first quarter was about 3% below the amount sold in the first quarter of last year.

The company now has a strong inventory position as a reserve for possible surges in world demand, and Canadian production is being reduced to the previously announced annual rate of 500,000 tons.

Mr. Davis said dividend policy will have to be reviewed in the light of the current outlook for earnings and the desire to devote a larger part of cash generation to fabricating developments.

Providing copper prices remain at approximately the present level, and estimating 1959 copper production to be in line with that of 1958, Weedon Pyrite & Copper Corp. Ltd. expects to enjoy important improvements in operations and earnings in the current year, according to the annual report for 1958.

With the mill treating a total of 138,-

Digging iron ore on the Mesabi Range near Aurora, Minnesota.

MARION 151-M—Power For Unmatched Digging in Mines and Quarries

A Marion 151-M in action is a familiar sight in many parts of the iron range, in copper mines, coal pits and quarries throughout the world. This 7-yard machine is ruggedly built throughout with ample power for continuous, high-speed production. It is readily convertible to dragline service with boom lengths from 80′ to 120′ and buckets from 4 to 8 yards.

A 40-ton Marion 43-M truck crane loads 69,000 pounds at 13 feet. Such standard features as a torque converter, Marionair Control, power raising and lowering of the gantry and ballast give the operator big advantages. The strong, highly mobile carrier provides maximum maneuverability during travel and on the job.

Consult Marion Mining Specialists for lower costs on your property.

MARION

MARION POWER SHOVEL COMPANY—MARION, OHIO, U. S. A.

A Division of Universal Marion Corporation

Quebec *(Continued)*

594 tons of ore compared with 107,418 tons in 1957, the company reports record metal production in the latest year, output of copper gaining 20%, zinc 4.8%, pyrite 36%, gold 2.7% and silver 3.5%. The mill averaged 418 tons a day versus 365 tons in 1957.

Operating profit for the year under review amounted to $36,745 as compared with $50,927 in 1957, while there was a net loss of $3,837 after all charges, including write-offs, with no allowance made for depreciation. Net loss in 1957 was $6,375.

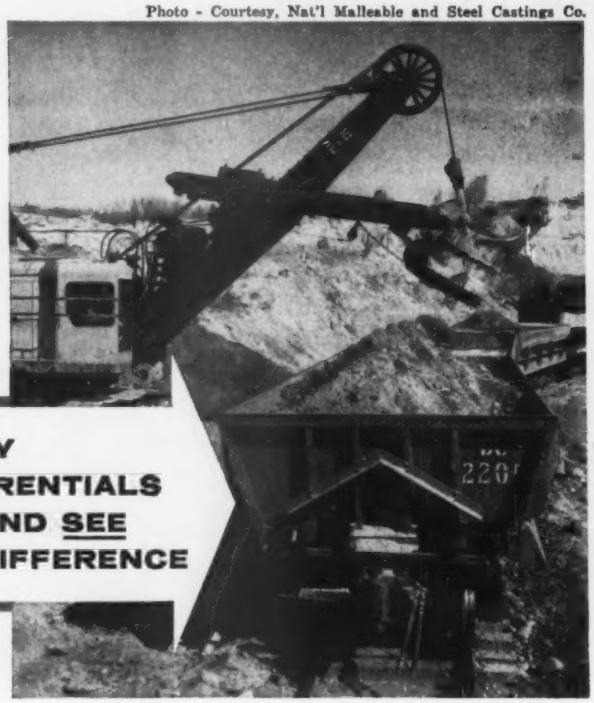
Considerable mine development and exploration work was undertaken during the year. Ore reserves now amount to 168,177 tons, averaging 2.14% Cu, 0.93% Zn and 29.98% S, with dilution expected to reduce these values somewhat.

In order to provide funds for deepening the present shaft, opening up the lower levels of the mine and for acceleration of outside exploration and development work, the company has signed an agreement with Jaclen Ltd. under which the latter will purchase 200,000 shares at 22½c a share and will take options on a further 600,000 shares at prices ranging from 22½c to 50c a share.

In co-operation with U.S. mining company, Weedon acquired 38 claims in the Weedon-Sherbrooke area during 1958. Only four of the eleven anomalies present were sufficiently attractive to warrant diamond drilling, and this work is presently under way without any conclusive results to date.

With mining operations now being enlarged to encompass outside exploration, shareholders will be asked at the annual meeting to approve changing the company's name to Weedon Mining Corp. (No Personal Liability).

Photo - Courtesy, Nat'l Malleable and Steel Castings Co.



TRY DIFFERENTIALS AND SEE THE DIFFERENCE

It takes a tough car to take it away, day after day. The many tons of heavy iron ore that fall relentlessly from the shovel demand a car that can take it.

Differential side dump cars — air powered — have been serving the industry for some decades, now, and their performance brings back steady repeat orders that speak for themselves.

Let us send you complete specifications and discuss your needs at your convenience. You'll like what you hear about Differentials.

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DIFFERENTIAL STEEL CAR COMPANY
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IN LATIN AMERICA

COLOMBIA

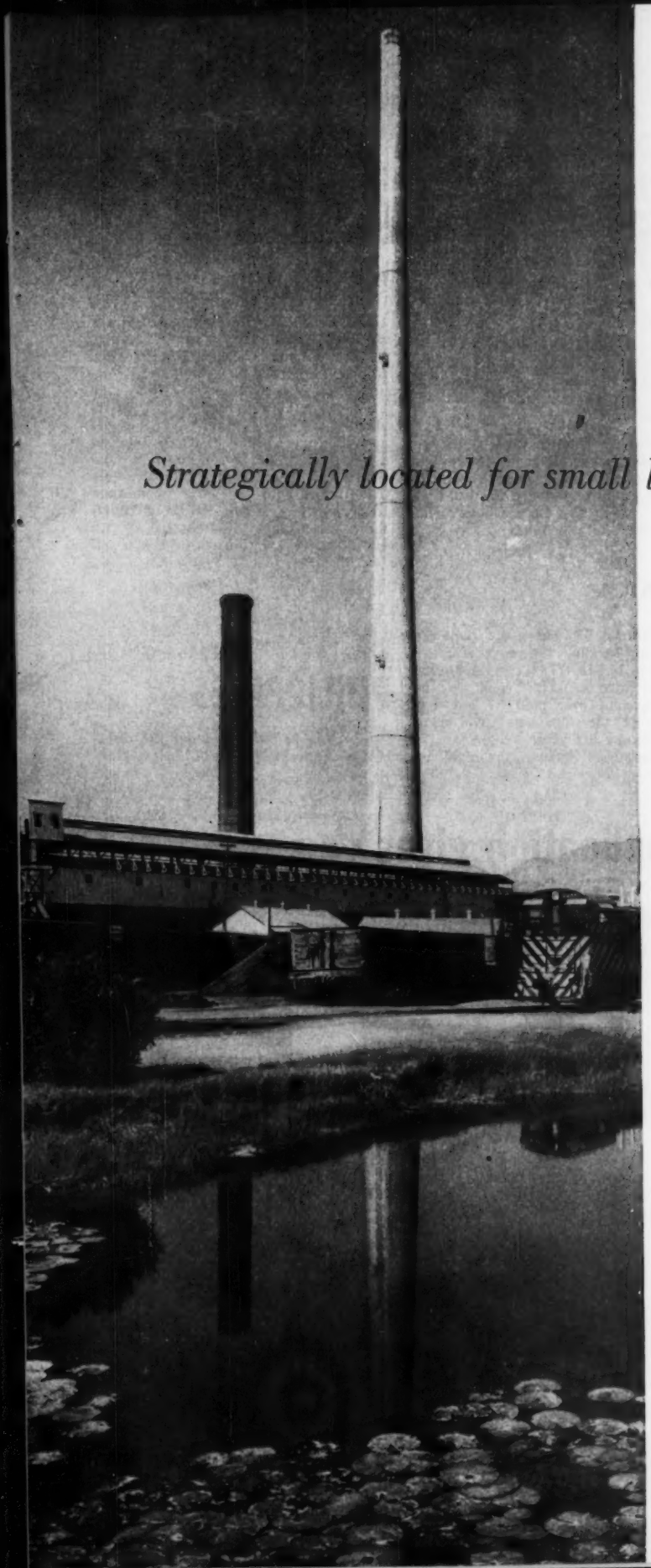
South American Gold & Platinum Co. reported preliminary earnings for 1958 of approximately $844,000, or 41c per common share based on 2,039,100 shares outstanding at December 31, 1958, compared with 1957 earnings of $3,400,000, or $1.75 per share based on the 1,942,000 shares then outstanding. Proceeds from sales of metals were $6,692,000, compared with $7,042,000 in the preceding year. Non-recurring net capital gain amounted to $522,000, compared with $1,589,000 the year before.

Lewis B. Harder, president, stated that "we hopefully anticipate an improved profit position in 1959 as a result of current and constructive discussions with the Colombian government, incident to the 15% export tax on precious metal production." He added that "present recovery of platinum prices to a higher and more realistic level, along with the scheduled commencement of gold dredging operations in Bolivia later this year, constitute important factors leading to conservative optimism for the company's performance during 1959." Mr. Harder pointed out that arbitration based on compatible terms has led to the conclusion of a 63-day strike at the company's Frontino Gold Mines, Ltd. property in Colombia.

CHILE

Mitsubishi Mining Co. made good its option to buy from Mr. Buenaventura the iron deposit known as Las Adrianitas, near Copiapo. High grade iron ore will be transported to the shipping wharf to be built at Calderilla (to the north of the port of Caldera) in large trucks and will be shipped to Japan. By diamond drilling, some 16-million tons of high-grade ore have been proved. $1.5-million were paid for the mine by Mitsubishi.

Because the oxide copper ore treated at Chuquicamata has fallen to 1% and does not give up as much acid as when 2% ore was treated (0.4 kilos per kilo of recovered copper), Chile Exploration Co. is building a FluoSolids—contact



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or write to main office.
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120 Broadway,
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58-54

ASARCO

Chile *(Continued)*

sulphuric acid plant at Chuqui to produce 50 metric tons of acid per day. As a source of sulphur, the pyrite contained in the tails of the flotation mill will be used.

Mantos Blancos Due In 1960

THE MANTOS BLANCOS copper mines, when onstream in 1960, are expected to turn out 1,500 tpm of refined copper. About $8-million has already been invested in the property—the total investment will exceed $18-million. Reserves of 10.5-million tons of ore have been proved. The mine will be an open pit and copper will be recovered by leach-cementation. A 100-tpd sulphuric acid plant is under construction which will require 30 to 50 tpd of refined sulphur. Ore haulers will be 25-ton trucks imported from the U.S. Three shovels are already on the property. The company will connect a rail line to the Antofagasta-Bolivia railroad. Construction work is in progress with a camp for 450 workers and 150 employees, a theater and sports-stadium and an electric power plant being built. The mine, in northern Chile, belongs to Mauricio Hochschild y Cia.

The Under Secretary for Mines, Senor Fontaine, and the vice president of the Mining Bank, Senor Valenzuela, recently paid a visit to the Paipote copper smelter and to the various flotation mills the Mining Bank operates in the northern provinces.

The present Administration has decided to ask Anaconda-Jurden to go over the design for the new copper smelter the government plans to have built at Ventanas where the output of all mills and mines of Central Chile will be smelted. The first unit of the smelter will have a capacity of 150,000 metric tons of charge per day.

The 75-tpd sulphuric acid plant built at the Caletones smelter of the Braden Copper Co. by Lurgi is operating successfully and is producing acid at 125% of design capacity.

Compania Acero del Pacifico, which has a considerable interest in the 100-million ton high-grade iron deposit of Algarrobro to the southwest of the town of Vallenar, will soon buy the machinery necessary to exploit the mine.

JAMAICA

Kaiser Bauxite Co. has made Jamaican history by handing the government a check for $4,338,417 (£1,549,434) for corporate income taxes. This is the largest amount ever paid by any one company to the Jamaican government in any income tax year.

The corporate income tax paid by Kaiser was levied on the shipping of 3,827,500 short tons of bauxite last year, a tonnage larger than that shipped for the first three years of Kaiser operation in Jamaica. It also represents more bauxite than that mined by both of the other two bauxite companies operating in Jamaica in 1958.

MEXICO

Colossus Nickel Development Ltd. of British Columbia, reports first shipment of ore to the Cananea Consolidated Copper Co. from its Promontorio mining operation at Alamos. More than 2,300 ft of the adit tunnel has been reclaimed with new track laid and water and air lines installed. One stope at 1,100 ft from the portal shows a consistent width of 5 ft and is in condition to be mined with very little preparation. Its presently reclaimed length of 100 ft shows an average grade of 0.6 oz Au and 60 oz Ag per ton with 5% Cu and 7% Pb.

IN THE PHILIPPINES

Prospecting in Surigao under the direction of Nestorio N. Lim of Surigao Con-

The proper bucket application gives you maximum cable life

New Blaw-Knox Booklet tells you how

Bulletin 2510 illustrates and describes in pictures and text the proper relationship between:

1. Preferred or required direction of bucket opening.
2. Location and contours of the pile of material.
3. Position of the holding and closing drums in the crane trolley.

Users report amazing increases in cable life as well as improved bucket performance as a result of applying these practical suggestions. A copy of Bulletin 2510 is yours without obligation. Write for a copy today.

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Blaw-Knox Equipment Division
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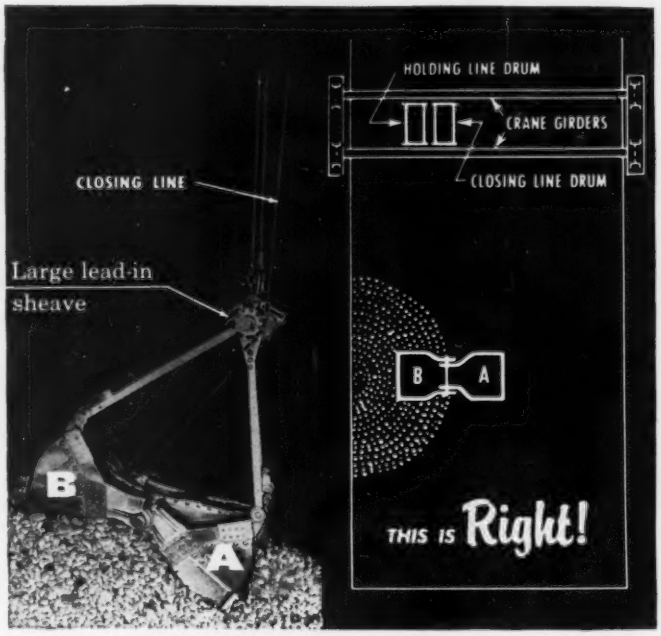


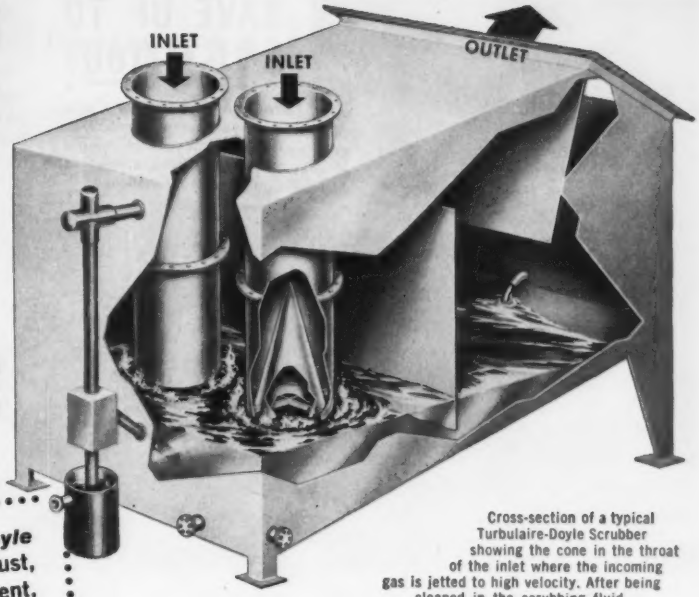
BLAW-KNOX

NEW

Savings and efficiencies in Gas Scrubber Applications

with the

TURBULAIRE-DOYLE SCRUBBER



Cross-section of a typical Turbulaire-Doyle Scrubber showing the cone in the throat of the inlet where the incoming gas is jetted to high velocity. After being cleaned in the scrubbing fluid, the gas passes over spray eliminator baffles before it is discharged. Collected material is carried away by the circulating scrubbing liquid—is recovered as a liquid concentrate or slurry.

With addition of the Turbulaire-Doyle Scrubber to its line of advanced dust, fume and fly ash collection equipment, there is no industrial gas cleaning problem that Western Precipitation cannot handle with equipment of its own design. This assures your dust and fume control problem receiving the benefit of the industry's most complete "know-how" in all phases of gas cleaning operations.

The Turbulaire-Doyle Scrubber—a development of The Consolidated Mining and Smelting Company of Canada Limited and widely used in its own diversified operations—is now made available to industry by Western Precipitation Corporation under a license arrangement with Cominco.

Actual plant records, compiled over long periods of service, show the Turbulaire-Doyle Scrubber to be unique among commercially-available scrubbers in the multiple advantages it offers...

★ *High Collection Efficiencies*—generally 97% to 99%!

★ *Fine Particle Collection*—including those in the fume range!

★ *Low Liquid-to-Gas Ratio*—only 1 to 5 GPM per 1000 CFM!

★ *Wide Application Flexibility*—readily adaptable to various types of corrosion-resistant materials!

SIMPLE, TROUBLE-FREE DESIGN

The Turbulaire-Doyle Scrubber impinges dust-laden gas at high velocity into a bath of scrubbing liquid. The high velocity forces the gas and dust particles to penetrate deeply into the liquid for complete wetting and cleansing. A cone in the gas inlet nozzle, just above the surface of the scrubbing bath, provides the jetting action that assures outstanding performance from this unit. *There are no moving parts, nothing to require frequent maintenance!*

If you have dust or fume control problems where scrubber types of collectors are applicable, it will pay you to investigate the *years-ahead* advantages of the Turbulaire-Doyle Scrubber. Write, wire or phone the Western Precipitation office nearest you for further details.

TYPICAL APPLICATIONS INCLUDE:

Cleaning Gases from sintering machines, blast furnaces, roasters, dryers, calciners, crushers, screens, ventilators etc., in a wide range of chemical, metallurgical, rock products, and waste disposal operations.

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COTTRELL Electrical Precipitators
MULTICLONE Mechanical Collectors
CMP Combination Units
DUALAIRE Jet-Cleaned Filters
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Engineers and Constructors of Equipment for Collection of Suspended Material from Gases . . . and Equipment for the Process Industries

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SAVE UP TO $1500.00!

You can get a Case W-5 with 1-cu. yd. bucket for $5975, F.O.B. factory, plus freight and taxes. Price subject to change without notice.

GET 73% MORE BREAKOUT

for faster cycles with new CASE® W-5 Terraload'r

You not only save up to $1500.00 in capital investment . . . you also gain more work output per dollar with the new high-speed, 3000-lb. capacity Case W-5 Terraload'r.

Unique combination of parallel hydraulic circuit, 30 gpm pump, and special tilt linkage gives the W-5 a breakaway force of *7800 lbs.* — 73% more than any competitive machine in its class. Result: operators get heaped loads faster, without "working" the bucket . . . save valuable seconds in every cycle. In addition, the W-5 gives you:

Faster maneuvering, with power-actuated forward-reverse shuttle shift, plus front-wheel-drive and rear-wheel power-steer — turns in 10'4" radius.

Better balance, with 24.2% more empty weight on rear wheels, for carrying heaped loads at higher speeds.

More power and efficiency, with heavy-duty Case-built gasoline engine, plus torque-converter drive.

For more information on the new W-5, call your nearby Case Industrial Dealer, or write us direct. Remember, too, Case also builds a larger 6000-lb. capacity 4-wheel-drive Terraload'r, as well as *crawler*-mounted loaders, from ⅝ to 2-cu. yd. capacity to meet your most exacting requirements.

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Philippines *(Continued)*

solidated Mining Co. has revealed an interesting new copper orebody in Dumingag, Zamboanga del Sur. The country rock is andesites with veins showing chalcopyrite and pyrite. Eight veins are exposed which can be traced over 1,000 ft on their strike. The new discovery is about 50 km north of Pagadian and 25 km from the company's iron ore deposit which is now being drilled. About 4-million tons of high grade iron ore have already been exposed. Three diamond drills are at work. A 30-km aerial tram will be built to convey the ore to tidewater for shipment to Japan.

Another new prospect has been found by Surigao engineers on Guinaras Island located between Panay and Negros. This property was formerly explored by Hixbar Mining Co. before being relocated by Suricon. Two veins are visible carrying chalcopyrite and oxide copper. Development is going on by trenching and drifting.

Lepanto Consolidated had a better year in 1958 than 1957. Copper sales exceeded $9-million and net profit after taxes was $1,670,000 compared to $1,270,000 the year earlier; over $1-million in dividends was paid. In March this year, the company milled 38,300 tons of 3% Cu ore estimated to contain 2,240,000 lb of copper and 4,980 oz Au.

Consolidated Mines shipped 44,700 tons of refractory chromite ore in March, valued at $932,000. Jose Olondriz has been elected president of the company. Mining operations are conducted by Benguet Consolidated under a profit sharing agreement.

March production at the Toledo mine of Atlas Consolidated was 3,780,000 lb of copper from milling 378,855 tons of ore assaying 0.64% Cu. The output was valued at $1,147,000 at 30¢ copper. This compares with production of 3,880,000 lb of copper in February from 0.68% Cu ore.

Stockholders of Atlas Consolidated were informed that development work during 1958 added materially to ore reserves but it became apparent from this work and from mining operations that the average grade of the ore had declined. A revaluation program has been scheduled for 1959.

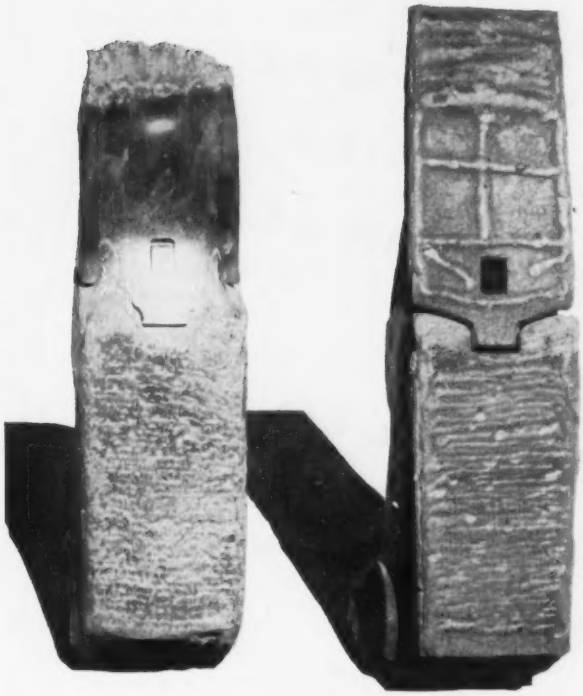
IN AUSTRALIA

Contrary to New York reports, Mt. Isa Mines Ltd. will not make further cuts in lead production. Mr. Isa's chairman, G. R. Fisher states that big increases in copper output have balanced cuts made in lead production and that the mine still expects to operate at 8,000 tpd. Copper ore output will be increased further while lead production is expected to stay at about 55,000 annual tons.

South Alligator Uranium N.L. reports that the construction of its uranium treatment plant is on schedule and

All Teeth Stay Sharper, Last Longer with

Stoody TUBE BORIUM!



ROAD RIPPER TEETH *averaged 7 to 10 times more life after receiving protection with Tube Borium. Notice how tooth chisels down with wear.*

Wear and loss of digging efficiency are common complaints on all types of teeth—*ditchers, power shovels, rippers, draglines, dredges, etc.* Hard-facing greatly prolongs useful life. But even so, each tooth can be made to last *far longer than ever before* and *retain its sharpness* by hard-facing with Stoody TUBE BORIUM!

Why is this one hard-facing alloy so superior on teeth? *No other hard metal equals TUBE BORIUM in straight abrasion resistance.* Its deposits are thickly peppered with tiny tungsten carbide particles. Wear is virtually defied by this hardest-of all man-made metals.

More expensive in first cost, Tube Borium shows excellent economy in overall service life, outlasting other materials many times over. And longevity is not your only benefit. Remember, one major cost of any hard-facing application is welding time. Use the best, Tube Borium, and you'll save several applications of less effective alloys besides eliminating needless downtime!

Your Stoody dealer (check the Yellow Pages of your phone book) will supply details, literature or recommendations. Ask about Tube Borium—or write direct.

SHOVEL TEETH *wore out in one 8-hour shift. A few beads of Tube Borium applied during noon break prolong life 6 or 8 full shifts. They are then repointed and hard-faced for further use.*

DRAG LINE TEETH *used in slag dump were hard-faced with Electric Tube Borium—outlasted unprotected teeth 9 to 12 times.*

TUBE BORIUM is available in stick form for oxy-acetylene or manual electric application. Also in continuous wires for automatic and semi-automatic electric application. Various mesh sizes for individual uses.

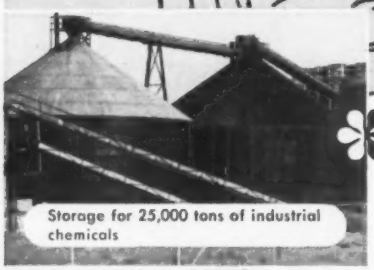
DITCHER TEETH—*A few ounces of 30-40 Electric Tube Borium on points of teeth increased life 6 to 8 times over factory originals.*

STOODY COMPANY

11930 East Slauson Avenue • Whittier, California

West End "fills the order"...

TO PLANT 9/11 2:35 P M
HAZCO URGENTLY NEEDS EXTRA
HOPPER CAR SODA ASH FROM TANK
6 SHIPPED TODAY. ADVISE. END
TO OFFICE
CAN DO. WILL PULL CAR FROM
STORAGE SPUR AND SHIP TODAY.
CAR NO. NAHX 31078.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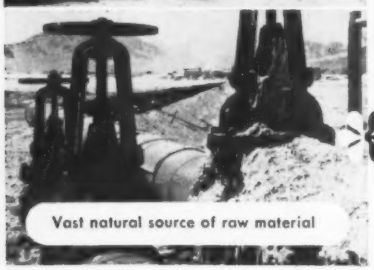
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Meeting service requirements to the letter and producing superior soda ash of consistently accurate particle size and chemical analysis are the essentials to which the West End organization is uniquely geared. A system of rapid communications linking our sales office in Oakland with our production, technical and shipping departments at the desert plant site permits each department head to have a complete understanding of the customer's individual requirements and to make firm commitments or provide the desired information promptly.

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EXECUTIVE OFFICES, 1956 WEBSTER, OAKLAND 12, CALIF. • PLANT, WESTEND, CALIF.

DIVISION OF Stauffer STAUFFER CHEMICAL COMPANY

Australia *(Continued)*

within the cost estimate. The 43 prefabricated acid-resistant process tanks are about to be installed while the crushing and grinding section are almost finished.

Broken Hill South Ltd. is expected to make an announcement about an impending partnership with other companies in the development of at least two new highly-promising locations outside the South mine leases. Three promising areas have been discovered but one of them will be worked by Broken Hill South alone.

Production of Central Norseman Gold Corp. N.L. again increased in the year to March 31 reaching a record 109,631 oz. Throughput rose from 172,195 to 190,157 tons with recovery grade rising from 11.12 to 11.53 dwt a ton.

Great Western Consol. N.L., treated smaller tonnage in year ended March 31 but a rise in ore grade brought about a slightly higher output. It milled 477,947 (535,198) tons for 81,173 (78,392) oz of gold.

Gold Mines of Kalgoorlie (Aust.) Ltd. production in the same period dropped from 144,881 oz gold to 142,454 oz including 8,863 (3,488) oz in concentrates even though the company milled 531,959 (526,328) tons of ore.

Hill 50 Gold Mine N.L. has discovered a new body of mineralisation on the main north drive with an estimated grade of 8.5 dwt/ton. Pattern drilling on the 1,552-ft level disclosed the new body which is estimated to contain about 80 tons a vertical foot.

IN AFRICA

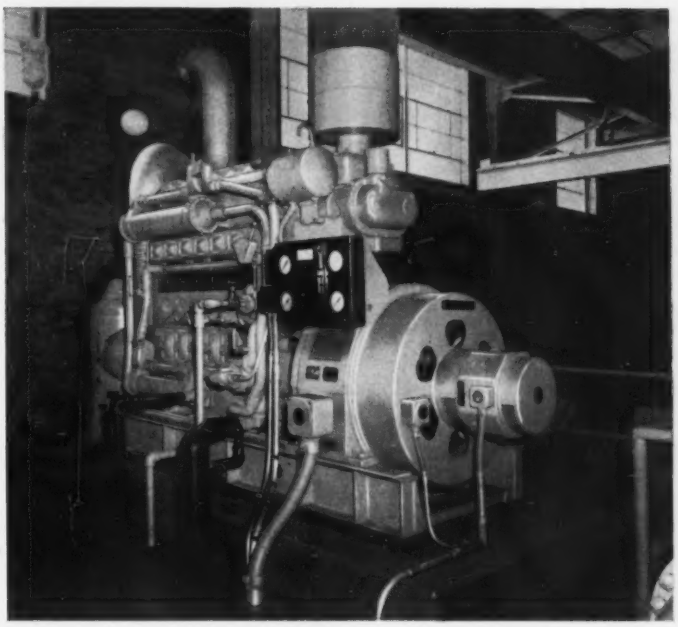
While much publicity has been given in South Africa to the economic difficulties created by the closing down of old, uneconomic gold mines, there is one problem that has hardly ever been discussed outside mining circles—the water problem left by old workings as a legacy to survivors in the neighborhood.

When a mine closes down it stops pumping the water that is continuously accumulating underground, and since underground water knows no boundaries, neighboring properties have to assume the pumping burden. This raises capital outlays and working costs, reduces ore tonnages that can be mined economically and shortens the lives of neighboring mines.

The problem has been raised in the annual report of the South African Land & Exploration Co. The mine—one of the Anglo American group—is situated on the east Witwatersrand. Its surrounding mines are Van Wyk, Brakpan and Springs. South African Land expects to spend £293,000 ($820,000) in this financial year alone on pumping equipment and settling dams for water which will flow into the mines when the other mines eventually close down.

Picture of O-P economy!

Ohio pumping station saves $300 a month using **F-M** Opposed-Piston standby diesel for both power generation and pumping



Compact, lightweight Model 38F5¼ O-P is rated 450 hp. at 1200 rpm., direct drives a 175-kw. F-M alternator and, through right-angle gears, an F-M Pomona Vertical Turbine Pump with 5.5 mgd. capacity at discharge pressure of 105 psi.

Electric power off the flywheel end, high-service pumping off the front—that's the standby job cut out for this Model 38F5¼ Fairbanks-Morse O-P Diesel in the Elyria, Ohio water works serving 60,000 people.

Called into service for 3 to 6 hours a day in the Spring of 1958, the O-P pumped water for $1.50 less per million gallons than purchased power—a $300 per month reduction, including savings on demand charges. Each Saturday the engine makes a test run as the sole high-service on the line.

Versatile as well as economical, the Model 38F5¼ O-P is also ideal for direct-driving other equipment off the rear, with front end of shaft driving an auxiliary generator, crusher, pump, etc. The O-P can be furnished for either diesel, dual-fuel, or spark-ignited operation, and is available as a complete packaged unit with all accessories attached to the frame. Write Fairbanks, Morse & Co., 600 S. Michigan Ave., Chicago 5, Ill.

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Africa *(Continued)*

A diamond core drill capable of drilling to a record depth of 15,000 ft and more is being designed by Joy-Sullivan (Africa) Pty. Ltd. The company hopes to be in production shortly with this device, the first of which should be in operation in South Africa in September.

It will be the first time a diamond drill capable of reaching such a great depth has been produced anywhere in the world. Only a few years ago diamond drilling to a depth of 10,000 ft was exceptional. There was little point in going deeper because the problems of mining at greater depths had not then been overcome.

The effect was that many areas in the country where gold-bearing ore was likely to exist in payable quantities were just out of reach. Prospecting in these areas is now beginning to go forward. A further incentive to carry out ambitious prospecting at depth was given in last year's national budget through the abolition of Union taxation on revenue from profits spent on prospecting.

Modernization of the only working graphite mine in Kenya (East Africa) is expected to increase production from the present level of 1,500 tpy to 2,500 tons with an estimated value of more than £100,000 ($280,000). At present, about 15,000 tons of ore are treated annually and equipment has been installed to produce both high carbon flake and powdered graphite. The mine, discovered in 1950, belongs to pioneer merchants in the territory, the Shah Vershi Devshi & Co.

Concern is being felt by the mining industry in Southern Rhodesia at the new increased power tariff proposed by the territory's Electricity Supply Commission. It is feared that the imposition of the higher rates may force the closure of numbers of small mines.

The white mineworkers' union in Northern Rhodesia has been warned that zinc and lead mining in Northern Rhodesia will be hard hit if they continue to press for an increase in pay. The warning was given by Harry Oppenheimer, chairman of the Rhodesia Broken Hill Development Co., which mines all lead and zinc in the country. Broken Hill's profits dropped sharply last year by $1,120,000.

Practically all the important mining houses in the Union are at present engaged in an intensive large-scale search for new mineral deposits in Central Africa. Among the most prominent is Anglo American which holds prospecting rights over an area of 120,000 sq miles in Northern Rhodesia and 35,000 sq miles in Tanganyika.

The task of prospecting these vast areas could involve the group in formidable expenditure. Most of the territory is entirely undeveloped, lacking all but the most primitive communications and impassable during the wet season.

In the case of Tanganyika, Anglo American has devised a four-stage program which will take six years to complete, as outlined in the current issue of OPTIMA, the group's quarterly journal.

The first stage was to obtain an overall picture of the geology of the 35,000-sq mile territory. This was achieved by photographing the area from the air together with an intensive geological survey from the ground on sample areas.

The second stage, which is now being carried out, involves the use of field parties who travel over the area on foot at planned intervals with priorities determined by interpretations of the geological map.

The Rand Mines group is another mining house with its eyes on the mineral riches of the Union's northern neighbors. Trenching and small shafts have exposed new and promising copper deposits in Southern Rhodesia. The group has applied for exclusive prospecting reservations over an area of 500 sq miles in an area 40 miles north-east of Kario.

Rand Mines is committed to an expenditure of £130,000 ($364,000) on prospecting in the area. Since October, six geologists in the organization have been probing the deposits over which it now has an option. It is understood that ore carrying 2.5% Cu was exposed by the original prospecting at Kario, carried out in that instance by the Nyaschere Copper Co.

Plans are being made to intensify the drilling operations to determine the ex-

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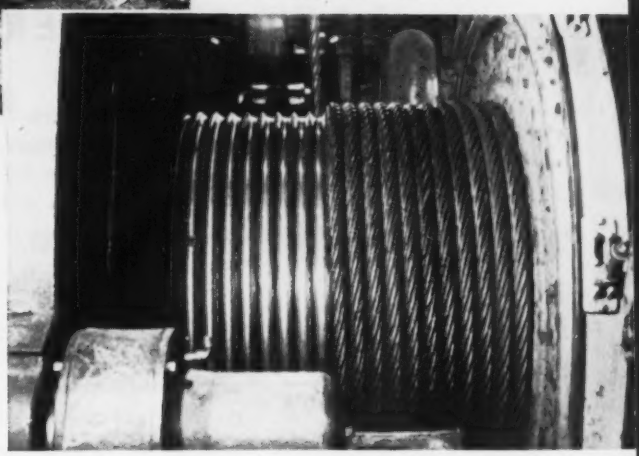
2⅝" Tiger Brand hoist ropes going through the boom point sheaves.

40-cubic-yard shovel stripping overburden at the Little Sister Mine of the Truax Traer Coal Company, St. David, Illinois.

Main hoist drum with well-lubricated Tiger Brand Rope in excellent condition after long service.



USS Tiger Brand— America's No.1 Wire Rope used on most big shovels

This 40-cubic-yard shovel, owned by the Truax Traer Coal Company, has been removing overburden at the Little Sister Mine near St. David, Illinois, for more than nine years. The hoist line is a 550-foot, 2⅜-inch diameter Tiger Brand Wire Rope, and the four boom supports are also Tiger Brand.

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Africa *(Continued)*

tent and copper content of the ore over an area big enough to justify full-scale mining. The whole project is significant in that it is the first time that Rand Mines has taken a direct interest in a Southern Rhodesian mining prospect.

The South African Railways is encouraging chrome exports to the U.S. market by keeping freight rates low, said Southern Rhodesia's Minister for the Treasury and Mines, Cyril J. Hatty, at the annual general meeting of the Southern Rhodesian Chamber of Mines.

In direct contrast, said Hatty, Rhodesia Railways, whose previously high freight rate has just been subjected to a further increase of 10%, are stifling Rhodesian chrome exporters' efforts to compete in the U.S. market.

This increase in rail rates will undoubtedly affect the chrome industry, and the Southern Rhodesian Chamber of Mines, supported by the Southern Rhodesian state government, is likely to clash with the federal government of Rhodesia and Nyasaland (which owns Rhodesia Railways) over the increases.

A longstanding dispute between farmers and miners over prospecting rights in Southern Rhodesia has resulted in a working party being set up by the Southern Rhodesia Government to report on the existing Mining Legislation and make recommendations for changing it.

In the past, farmers have complained that anyone with a $2.80 prospecting license can prospect and peg claims on farming land without further authority.

The working party, consisting of officials from the Southern Rhodesian Chamber of Mines and the Rhodesia National Farmers' Union, has recommended that in the case of a dispute, prospectors must convince the government Mining Affairs Board that there are exploitable mineral deposits on the farming land, and must guarantee compensation to the farmer.

Two important mineral discoveries were made in the barren Petauke region of Northern Rhodesia last year according to a report by the government Geological Survey Department. Sizeable deposits of metallic sulphide were found in the Petauke area; occurrences so far examined are mainly iron, but their presence is believed to indicate deposits of copper, cobalt or nickel sulphides in the same area. Also a large graphite body extending for two miles along a valley and maintaining a width of 200 to 300 yards was uncovered.

Both discoveries are in areas that are sparsely populated and are served by poor roads. The nearest railhead is at Lusaka, 300 miles away, so that if the deposits are to be exploited, transport will be the major problem.

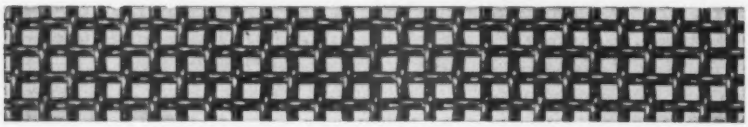
A new process which lines shafts with concrete ten times faster than the conventional method is being used at the Kariba hydro-electric scheme in the Federation of Rhodesia and Nyasaland. The process, called the Prometo System, employs the use of a sliding shutter raised by hydraulic jacks at the rate of 10-in. per hour.

Altogether eleven shafts and the walls of the gigantic transformer house will be lined using this method, by a firm of civil engineers subcontracting to the main contractors, Impresit of Italy. The firm has claimed a record in lining a cable shaft 480-ft high in three weeks using a six-man team working 24 hours a day.

Rhodesia's largest lithium mine, Bikita Minerals, near Fort Victoria is to close early next year. It is understood that one reason for the closure is that lithium is being produced in the U.S. at a price which makes the Rhodesian mine noncompetitive. About 30 European families and some 400 negroes will be affected by the decision.

South-West Africa has resumed manganese ore shipments after a break of some months. The total sales of ore from the territory amounted to 11,576 short tons in January with a value of £110,000 ($308,000); production in the same month amounted to just under 3,000 short tons.

The Mashaba Rhodesian Asbestos Co. Ltd. has exercised options on the D.S.O. and Rosey Cross asbestos mines in the Victoria mining district of Southern Rhodesia.



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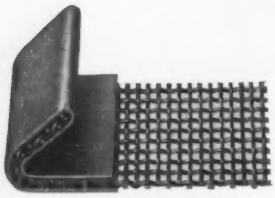

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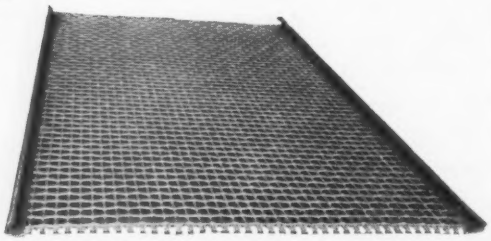

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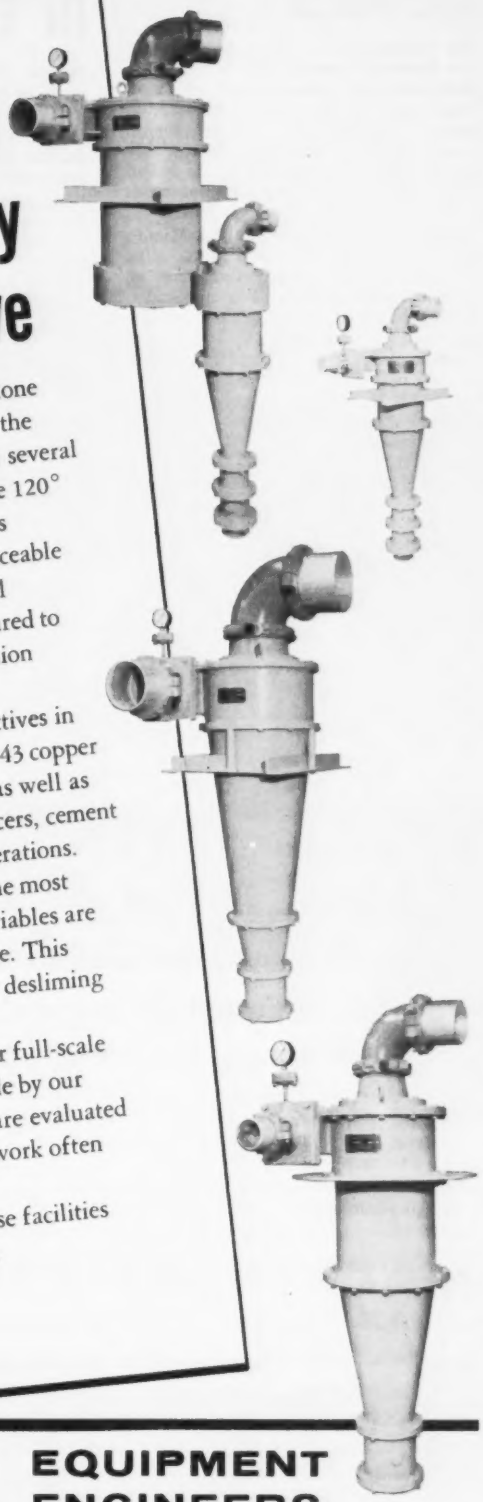

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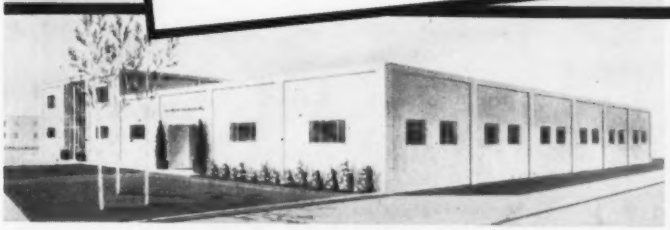

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Africa *(Continued)*

The opening of two large mines in the new Eastern Transvaal goldfield is foreshadowed in the annual report of Union Corp., one of the Rand's major gold houses. Winkelhaak, another Union Corp. mine in the same area, has already reached the production stage. A fourth mine is mentioned as a possibility.

The corporation's report says it is intended shortly to apply to the Mining Leases Board for two leases in the Kinross area of the Eastern Transvaal. A further possible lease area is still under investigation and more drilling will be undertaken in the area.

Although precise information about the two new gold mines is lacking it is likely that they will be comparable in size to Winkelhaak on which about £8-million ($22.4-million) has already been spent to bring it into production; more will be spent before full production is reached. While the two new mines are being brought to production, business and labor will be sharing the benefits of capital outlays totalling perhaps $45-million on such items as housing, salaries and wages, plant, equipment, stores, food, power and acquisition of property.

And although Winkelhaak is only in its early production stages it is already yielding foreign exchange in the form of gold at the rate of about £2.5-million annually.

IN EUROPE

Within the next four years, Bulgaria plans to increase annual coal production to 19-million tons, iron ore production to 380,000 tons, lead and zinc ore production to 2.9-million tons and copper ore production to 987,000 tons.

An extensive investment program calls for establishment of 24 new coal mines and 16 new ore mines by 1962. Additionally, a number of refining plants will be built and existing mines will be modernized.

Bulgaria, which until recently was not even mentioned in the annual statistical books for mineral resources, attained such successes within a few years that today it ranks high in Europe in lead reserves.

The total reserves of lead and zinc ore rose from about 1-million tons in 1949 to about 112-million tons in 1958, containing over 3-million tons of lead and over 2-million tons of zinc. Taking into consideration the lead ore in the Kremikovtsi iron ore deposits, which amounts to about 1.1-million tons of lead, the total lead reserves at the end of 1958 amounted to 4.2-million tons of metal.

Total copper ore reserves rose from 250,000 tons in 1949 to more than 60-million tons of ore at the end of 1958, with a total of 600,000 tons of copper.

The reserves of iron ore rose from 1.2-million tons of ore in 1949 to about 300-million tons.

Austria's Oberste Bergbehoerde, a branch of the Federal Ministry of Trade & Reconstruction, has published official data on 1958's mining activities:

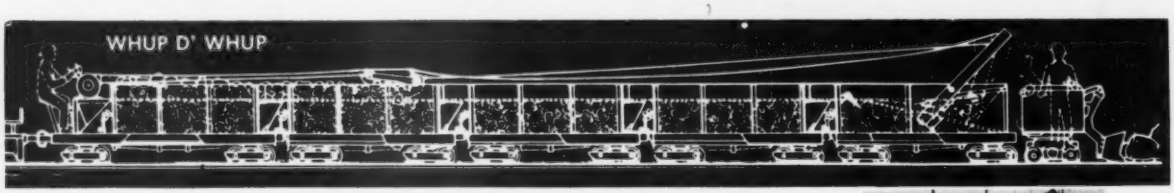
Coal mining yielded 141,048 metric tons of hard coal, 1,138,266 metric tons of sub-bituminous coal, and 5,355,330 metric tons of lignite. The labor force amounted to 1,306 employees, and 17,036 manual workers.

Iron ore output was 3,410,381 metric tons; micaceous iron ore, 2,805; and manganese ore, 300 metric tons. Production of lead-zinc ore was 187,912 metric tons; copper ore, 164,489 metric tons; antimony ore output was 11,198; tungsten ore, 5,820 metric tons.

Bauxite was 23,570 metric tons; gypsum, 422,281; anhydrite, 119,707 metric tons; barium sulphate, 4,277; graphite, 21,154; and magnesite, 1,221,193 metric tons. Talc and slate, 70,828 metric tons; kaolin, 300,265; clay, 116,565; bentonite, 3,810 metric tons; quartzite, 89,862; sand, 185,973; and feldspar 2,655 metric tons.

On the whole, 1958 output remained about at the 1957 level, the Supreme Mining Authority announced.

The complex processing of ore mined at Chvaletice (Bohemia) — consisting of



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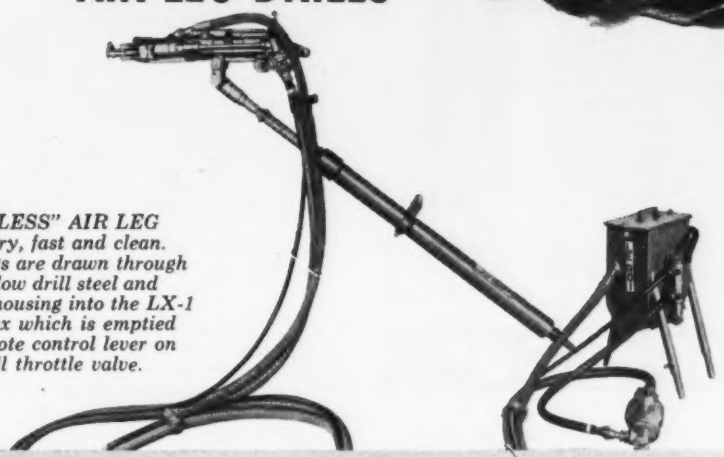

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Europe *(Continued)*

shale pyrites and iron manganese ore—is planned by the Czech Heavy Industry Ministry, according to HOSPODARSKE NOVINY, the Czech economics weekly.

The deposits consist of alternate layers of pyrites and iron ore. A small mining and processing enterprise located in Chvaletice recovers sulphur through flotation. The low Mn- and Fe-content ore, however, is a waste material.

Teams of the Czech Academy of Science have for years worked on a method for the complex processing of the waste. The first test unit, employing the new (so far undisclosed) method at Chvaletice, is to be erected before the year's end. It is expected that sulphur, iron, and high-quality ferromanganese could be derived simultaneously.

The resolution of the III Congress of the Polish Communist United Workers Party issued on March 22, 1959 presents the intentions of the government in regard to the development of the national economy during the 1960 to 1965 period.

The output of lead, amounting to 35,100 metric tons in 1958, is to rise to 40,000 metric tons in 1960, and 52,000 metric tons by 1965. Zinc production is to increase from 162,600 to 170,000 metric tons and 230,000 metric tons, respectively.

The output of electrolytic copper is to increase from 17,400 metric tons in 1958 to 35,000 metric tons in 1965, after a level of 25,800 metric tons has been scheduled for 1960. The aluminum output was 22,400 metric tons in 1958; will be 23,000 metric tons in 1960, and 75,000 metric tons in 1965.

The mining of sulphur will increase from 13,300 metric tons in 1958 to 40,800 metric tons in 1960, and as much as 410,000 metric tons in 1965.

Copper deposits estimated to contain about 10-million metric tons of copper were discovered in Lower Silesia (formerly German territory), TASS reports from Warsaw.

The deposits are scattered over an area of about 200-sq kilometers; the proven deposits make it certain that Poland now is one of the foremost places in the list of European copper producers.

Planned for commissioning in late 1959 is the processing center of Konrad, scheduled to yield 500,000 metric tons of copper ore. A new flotation plant is planned.

Expansion work of the mines of Boleslawiec and Zlotoryja and the founding of four new mines will bring copper ore output in Lower Silesia province to 2-million metric tons per year after 1965.

The short transport lines from the world's second largest sulphur producer —Poland—to the quantity market of west and east Europe will end sulphur shipments to Europe from other continents, Radio Warsaw speculates.

Poland's position as second-largest sulphur country of the world is but four years old; the reserves of Tarnobrzeg were then discovered and mapped.

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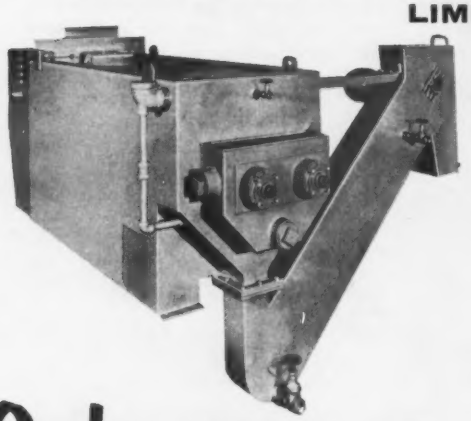

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Europe *(Continued)*

Czech, Soviet and east European funds are engaged in the first sulphur mine of Piaseczno; a 1958 output of 400,000 metric tons is claimed by the Poles. Scientific work performed at the Warsaw and Krakow Polytechnica ended in the working out of a new process for the Tarnobrzeg sulphur, the process yielding concentrates of 85% S.

On the processing side, the Machov Chemical Combine was started last year. The plan for the Piaseczno mine calls for an output of 100,000 metric tons of ore in 1959, and 2-million metric tons in 1965. The Machov plant is then to yield 100,000 metric tons of high sulphur concentrate in 1961, and 400,000 metric tons in 1965.

A sulphuric acid plant also is to be built in Machov. Its starting capacity has been set at 100,000 metric tons in 1961, and 500,000 metric tons/year "after several years." The third part of the Machov combine will be a superphosphate fertilizer plant, with an initial capacity of 200,000 metric tons per year, and an ultimate capacity of 600,000 metric tons.

One of the 1959 Lenin Prizes, Soviet Russia's highest scientific order, was awarded Professor Dr. Habib Abdullajev, president of the Uzbek Academy of Sciences, TASS reports. Prof. Abdullajev claims that ore deposits were formed where chemical structure and physical conditions of the earth's crust were favorable to the magma penetrating from the earth's core.

The Uzbek professor maintains that the school of thought believing that the magma itself governs the formation of the various metals' deposits—by variations within magma qualities and properties—is wrong. The magma, the scientist says, is a chemically and physically uniform mass, which can produce either gold, silver, copper, or any other metal as well; the deciding factor being the "geological milieu" into which the magma rises, and the elements found there.

The Tashkent Geological School, which Habib Abdullajev heads, has created a geological map on the strength of these theories, outlines the areas where the various deposits would be theoretically located—provided the earth crust were infiltrated by magma—calling his theory "petrometallogonie." The practical aspect of his theory was the discovery of three important lead deposits.

During the first three quarters of 1958, industrial output of the Soviet Union was 10% higher than last year, according to recently released government figures.

A breakdown showed that production of ferrous and non-ferrous metals was up 9%, fuel and power 10%, machine tools 14%, chemicals and rubber 12%, and building materials 25%.

The report of the Central Statistical Board said that during the first nine months of this year, the USSR produced 29.1-million tons of pig iron, 40.8-million tons of steel. 31.9-million tons of rolled metal, 3.4-million tons of steel tubes,

A report on 3 years' experience loading boulders

Rubber-Tired Michigan increases output 35%

All over the world, more and more earthmovers are finding Michigan Tractor Shovels can effectively handle jobs once considered much too difficult for rubber-tired equipment.

You've probably read about—or seen—Michigans digging pit-run gravel. Or breaking out reinforced concrete. Or clearing trees and tangled brush. Now here's another dramatic application.

Crawlers slow

The company involved had always had trouble moving traprock and dolomite from pit to crusher. Crawlers were too slow to readily maintain increasing production requirements. So, management decided to try a high-speed Michigan Tractor Shovel.

Repairs reduced 50%

That was in 1954. Today, this company owns *six Michigan Tractor Shovels!* These units handle *all* rock cleanup—moving thousands of tons of traprock, dolomite, and limestone. They also handle truck-loading of screened aggregates and other products of the multi-million-ton crushed stone plant. Management estimates output per Michigan "at least 35% greater" than output of each loader formerly used. Maintenance costs, over periods ranging up to three years, "have been cut in half!"

Boulders weigh 1 to 3 tons each

Note the photo above. Here, one of the company's five 2¾ yard Michigan Model 175A's is handling the rock. Each rock weighs 1 to 3 tons, yet at no time have the Michigan operators reported trouble loading or carrying them.

Load 10 tons in 2 to 3 minutes

On aggregate loading, the company keeps its 2 yard Model 125A busy (and any of the Model 175A's not loading rock). Here, unexcelled breakout makes quick work of the job. The Model 125A needs only 3 minutes to heap a typical 10 yard truck . . . the bigger Model 175A's usually take a minute *less* than that.

27 mph travel speeds odd jobs

Michigan speed pays off on odd jobs, too. Like cleanup of haul roads, pit floor, stockpiles, and around crushers. Pushing loaded trucks up grade. Hoisting heavy equipment. Switching railroad cars. Despite year-around work averaging 50 hours a week, company officials report "downtime negligible." And continuing, "We like the speed of loading, the truck-like speed between job sites, and the ease of maintenance. That is why we've been repeat-buyers five times!"

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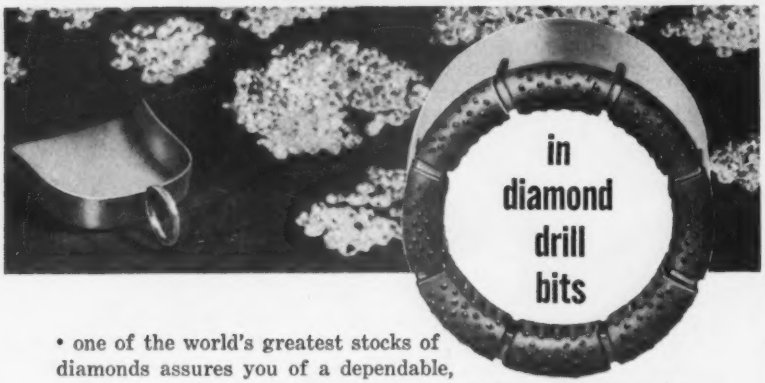

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Europe *(Continued)*

37.8-million tons of coke, 66.1-million tons of iron ore, and 371-million tons of coal.

New iron ore mines are reported to be opening in the Ukrainian regions of Kursk, Kremenschtschug, Kamyschburun, and Saporoschje. Ukrainian plans for 1959-1960 call for a 66% increase in iron ore production compared to this year when Ukrainia will produce 46-million tons, 56% of total Soviet iron ore production.

According to Tass, teams of Soviet geologists will attempt to drill the world's deepest well (present record—seven kilometers). Tass said that the drillhole will serve scientific, and not commercial purposes.

An automatic X-ray separator designed to mechanize the extraction of rock from high-grade coal is near completion at the Dnepropetrovsk selenium rectifier plant, according to the Moscow Bureau of McGraw-Hill World News.

The apparatus continuously examines the material moving along conveyors and sends impulses to mechanism which separate the coal from the rock. It is operated by remote control from the mine office. The separator, officials said, was one of ten automatic devices for use in coal mines developed at the plant this year.

Central Asia is to become the USSR's newest iron ore center, the Kazakhstan SSR possessing iron ore deposits estimated at 14,000-million metric tons. The annual iron ore yield is to increase to 26-million metric tons per year after 1965, the current Seven-Year Plan demands. The Kazakhstan deposits amounts to 20% of the total Soviet reserves, TASS revealed.

The Soviet nonferrous metals industry is to have an important extension in the projected "Orenburg" copper mine and processing center, according to TASS.

The new center is to supply all of the Ural area's copper needs from deposits discovered two years ago. The copper ore is to be mined simultaneously by the open-cast and the underground methods. The 1959 output target has been set at 2-million cubic meters of copper ore.

The open-cast mining will employ rotary-dredgers of 3,000-cubic meters hourly capacity and systems of conveyor belts to speed transport. The underground operation is to employ electric trains of 10- to 14-metric tons capacity.

Titanium deposits, also containing zirconium, have been found along the left bank of Dnjepr River, TASS announced. The deposits spread over several dozen sq kilometers.

The deposits are covered by sand layers ranging from 7 to 40 meters in thickness, so that open-cast mining techniques can be employed. The grain structure of the deposit permits the processing of the mined material without mechanical crushing.

A large processing center will be built at the upper part of the Dnjepr River;

When you're talking about a $162,000 dipper shovel, you've got to talk about the best rope for it

Talking about or working with, the same thing applies. Anything below Royal Blue's performance level is simply unrealistic. Like looking for a cut-price brain surgeon.

Even at $162,000, the cost of wire rope is important. That's why so-so ropes can cost you more in the long run, because so-so ropes are *short run*. Royal Blue, on the other hand, is built by America's oldest manufacturer of wire rope to last, to do the job without a whimper. Here's why.

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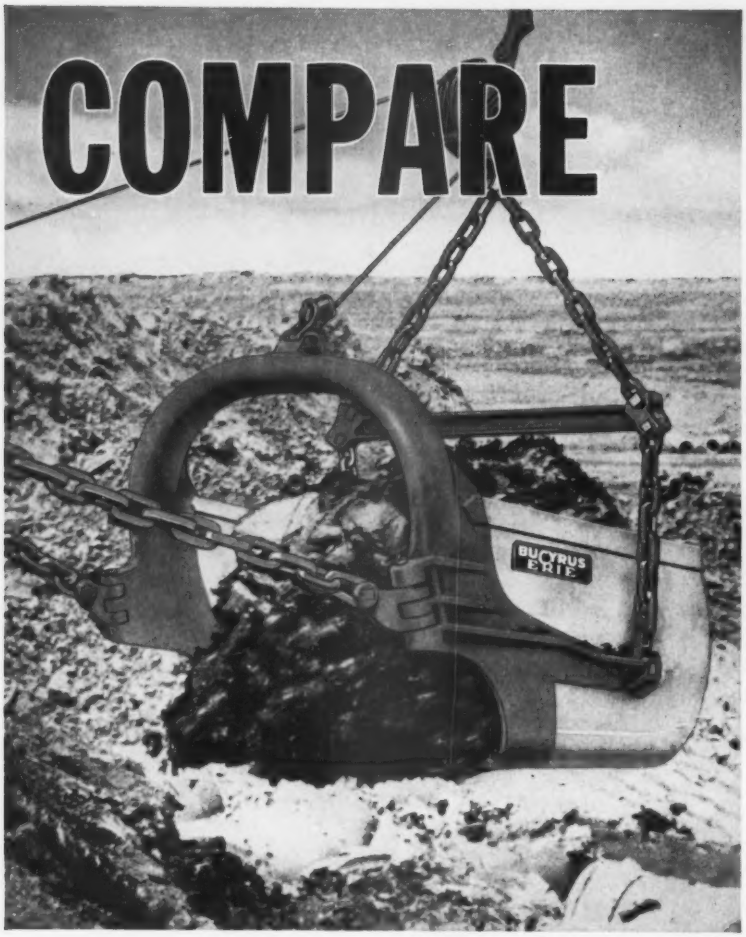

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Europe *(Continued)*

the entire mining operation, from use of dredgers to the processing in the projected plant is to take place mechanically, much of it automatically.

Manganese in pure form was produced by Lithuanian scientists, TASS reports. The adding of selenic acid alters the electrolytic process in such a way that no impurities are added to the manganese, and that less electricity is used in the processing stage.

The electric sedimentation of manganese alloys with iron, nickel, and cobalt as developed by Lithuanian Professor Janickis is employed now on an industrial level. Savings of nickel and a maximum corrosion resistance is the result of the galvanic application of manganese alloy layers on metal. The protective layer is of high gloss, durable and does not require polishing.

A bucket-wheel excavator is expected to cut open-pit mining costs by one-third in Soviet mines, according to TASS. The system consists of a bucket-wheel dry dredge with an hourly capacity of 3,700-cubic meters, a belt conveyor system, and a mobile material dumping machine. The dredge, with 10 buckets of 1,600-liters capacity each, can operate at a distance of 30 meters, at a height of 40 meters and a depth of 10. The conveyor system totals 2,000 meters in length made up in 500-meter sections of 2-meter belt width. The dumping mechanism places the material into dam-like piles, according to TASS.

IN ASIA

Two Indian firms have entered into agreements with the Continental Ore Corp. of New York for the sale of Indian ferromanganese ore.

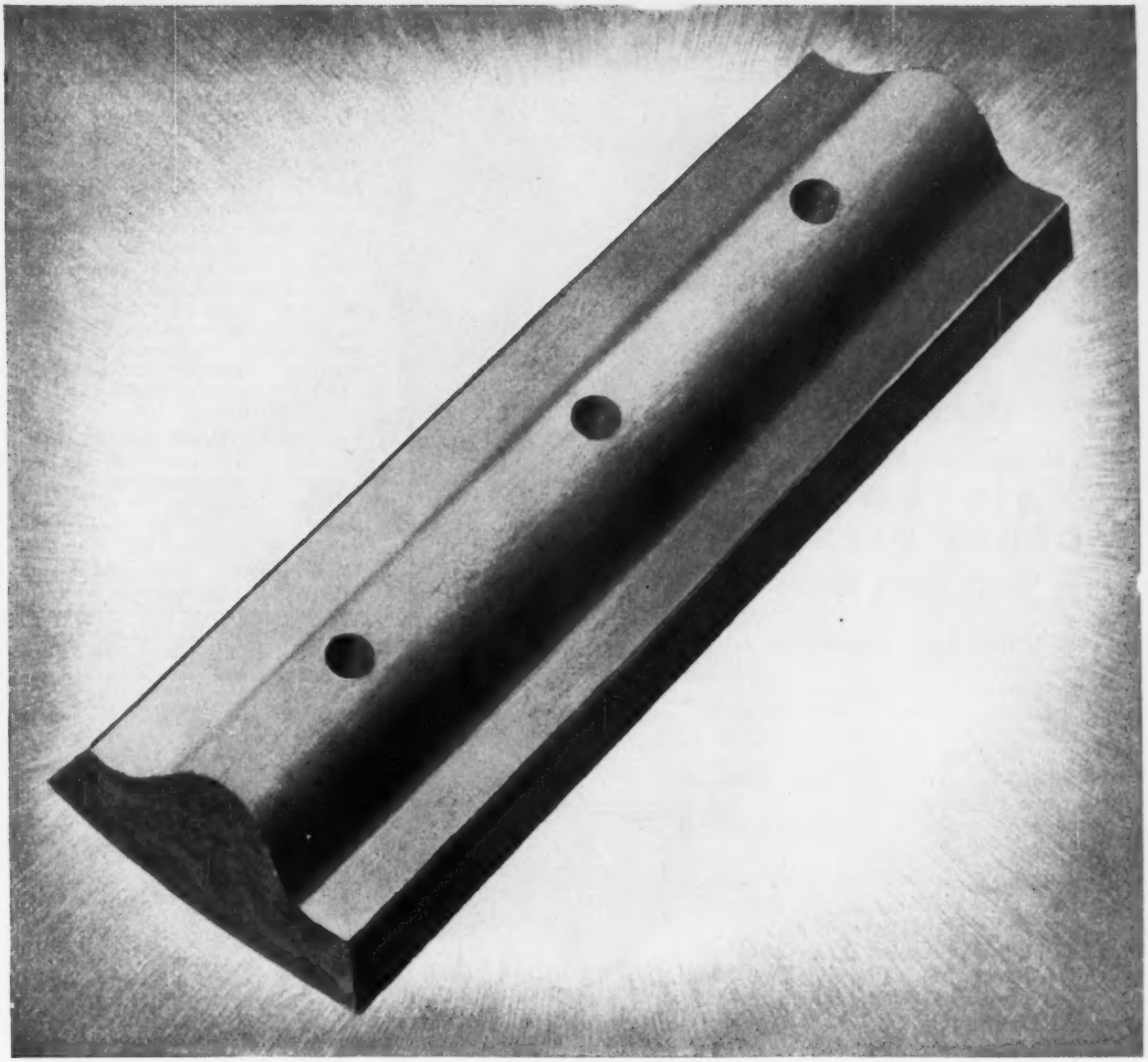
The agreement between the Continental and Cambata Ferro-Manganese Private Ltd., Bombay, specifies the sale of 30,000 tons of ore per year. It covers a period from the date of production (no precise date is stated) to December 31, 1964, with provision for fixation of price, for payment, quality, inspection, etc., and also for investment in the stock of the Indian company of up to 25%.

The second agreement is with the Khandelwal Ferro Alloys Ltd., also of Bombay, which recently was financially assisted by the K.A. Export Corp., also is for the sale of an annual 30,000 tons for a ten-year period.

On March 4, India and the U.S. signed a barter agreement for the exchange of 450,000 tons of wheat, valued at $31.5-millions for manganese, ferromanganese and other materials originating in India.

Rio Tinto Ltd. proposes to invest $1.26-million in the Zawar lead and zinc deposits in Rajahstan, India. Agreement to develop mine has been signed with Metal Corp. of India, Rio Tinto Management Services Ltd. says.

Rio Tinto and Indian Steel & Wire Products Co. Ltd. will each hold a 40%



LINER DIMENSIONS: WIDTH 18-3/4", LENGTH 36", BASE THICKNESS 3", WAVE 3-1/2"

NI-HARD DOUBLES MILL LINER LIFE

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Even hard taconite is no problem with Ni-Hard* nickel-chromium cast iron! That's why one plant – using chilled Ni-Hard (ABK Metal**) liners – was able to achieve double the life of any other liner material or design. The Ni-Hard liners ground over 2,200,000 tons of taconite ore in 10½′x16′ rod mills with 85 tons of 4″ rods rotating at 14.7 rpm.

Ni-Hard can mean important savings for you, too. Authorized producers throughout the country are ready to supply liner segments for your mills. Write Inco for the name and address of the one nearest you.

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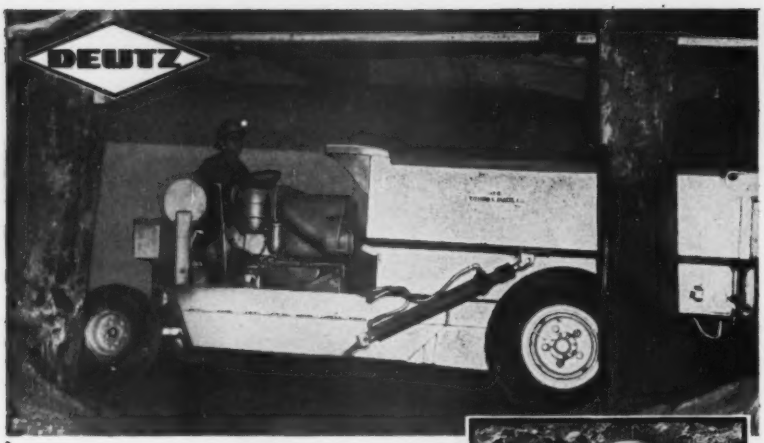


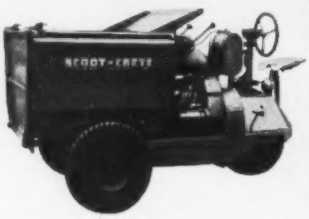
Utah Mining Truck Manufacturer Picks AIRCOOLED DEUTZ DIESELS for its Shuttle Buggies

Mine installation at Rock Springs, Arizona, uses ATLAS COPCO Compressor CT-6 with Deutz–6 cylinder A 6L 514 engine to assure top running efficiency in all temperatures. The semi-portable compressor provides 320 C.F.M.

The strenuous demands made on its mining trucks in the uranium country of the four corner area determined the selection of Deutz Air-cooled diesels by the Young's Machine Company in Monticello, Utah. Picking the quick-starting Deutz with its high fuel economy, no overheating and maintenance problems proved an invaluable aid in increasing sales for Young's.

In picking Deutz Air-cooled diesels Young's Machine Company joins a long list of American and foreign manufacturers in specifying the world's outstanding air-cooled diesel for their equipment. Only Deutz has these outstanding features:

- **A full range of Aircooled Diesels from 5 to 310 BHP in 1, 2, 3, 4, 6, 8 and 12 cylinders, all with individual cylinder units and interchangeable heads.**
- Top running capacity at temperatures ranging from −40° to +140° F.
- Less down time because higher head temperatures end corrosive sulphurous acid condensation.
- Greater fuel efficiency due to more thorough combustion.
- Complete service and parts facilities right where you need them.



GETMAN BROTHERS picked Aircooled Deutz Diesel Engines to power its Scoot-Crete Ore Carriers designed to carry loads up to 3500 lbs. and climbing 25° grades. Deutz was chosen for reliability, high fuel efficiency and minimum downtime.

PARTIAL SPECIFICATIONS TABLE

MODEL	BHP	RPM
F 1 L 712	10/12	2000/2300
F 2 L 712	20/24	2000/2300
F 3 L 712	30/39	2000/2300
F 4 L 712	40/52	2000/2300
F 6 L 712	60/78	2000/2300
A 2 L 514	28	1800
A 3 L 514	42	1800
A 4 L 514	56/72	1800/2000
A 6 L 514	84/110	1800/2000
A 8 L 614	112/145	1800/2000
A12 L 614	170/220	1800/2000

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Asia *(Continued)*

interest in Metal Corp. Loan funds have been arranged with the Indian government. Proposal will be submitted to Metal Corp.'s shareholders for ratification.

Mitsui Bussan, Mitsubishi Shoji and Kinoshita Shoten—the three major trading firms of Japan—will get together to export 50,600 tons of ferromanganese to the U.S. on barter for a total of 12-million tons of U.S. surplus farm products soon. The deal will entail $24-million both ways.

Japan did not import any U.S. surplus farm products last year, but in 1957 imported a total of 682,000 tons of wheat and barley worth $49-million on a loan basis from the U.S.

Peking radio recently said that a big ore crushing system has gone into operation in the Paiyungpo iron mine, 10 miles north of Paotow, one of the three major iron and steel centers now under construction in China.

The Federation of Malaya and the U.S. on April 21, 1959 signed an agreement to encourage private U.S. investment in the Federation. This agreement is designed to attract the private U.S. investor to put in capital into industry in the Federation.

The Investment Guaranty Agreement, as it is called, is the first of its type which the Federation Government has undertaken. The agreement signed provides that private U.S. investors wishing to put their capital into the Federation of Malaya can insure themselves against the risks of expropriation and of exchange control and currency restriction resulting in inconvertibility of Malayan currency into U.S. dollars, by taking out what amounts to an insurance policy with their own government.

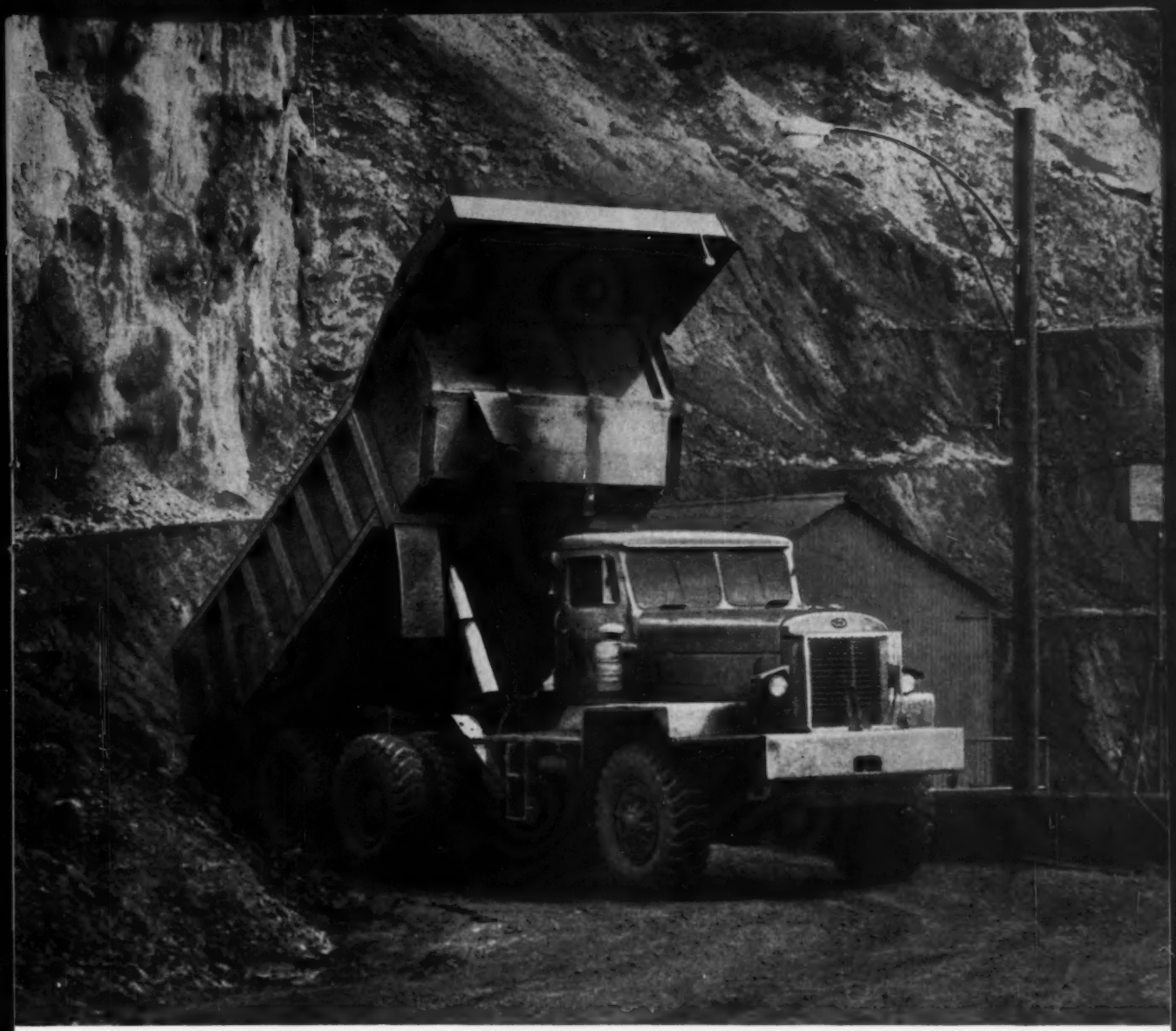
The U.S. Government on its part will indemnify the investor who takes out such a policy completely and promptly in case the risks mentioned materialize.

The advantage of such an agreement to the Federation is that it removes doubt and fear from the minds of potential U.S. investors that they might lose their investment as a result of political circumstances which cannot be foreseen and are beyond their control.

The simple ceremony which marked the signing of the agreement is described as a symbol of the greater understanding which is developing between the Federation and other friendly nations, and the agreement will be a significant contribution towards the Federation's effort to develop industry in Malaya.

Despite claimed discovery (December '57) of huge copper deposits in the Kilien mountain range of Southern Kansu, a joint Central Committee—State Council directive now describes copper and aluminum production as "a weak link" in Red China's industrial progress, falling "far behind" the needs of her machine-building and electrical industries.

First Five-Year Plan called for a 70% increase in copper production, but gave no base figure. Aluminum ingots were



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Asia *(Continued)*

targeted for 20,000 tons in 1957, 100,000 to 120,000 tons by 1962. Reds admit "a few" modern copper and aluminum industries were set up during the first five-year plan but claim a production increase of "several times" last year's output is now necessary to meet 1959 socialist construction demands.

IN THE MIDDLE EAST

Extensive mineral projects are outlined in the Egyptian Five-Year Plan released in 1957. These projects are expected to be implemented largely by Soviet technical assistance and equipment under the terms of the USSR-Egyptian Economic Agreement, signed Jan. 29, 1958. Included among the projects is a large deposit of high-grade ilmenite at Abu Ghalaga to be exploited at an eventual cost of about £500,000 by the General Ilmenite Co., which was established by the Economic Organization, a government holding company.

Abu Ghalaga is in the Hamata area of the Eastern Desert about 230 km south of Kossir and 700 km south of Suez. The ore, which is found in lenses in igneous rocks, is a titaniferous iron oxide, and will be transported to the Red Sea coast at Abu-Ghosoon by truck, crushed and screened, and shipped by sea. Further Russian sponsored projects under the Egyptian Five-Year Plan include mining of ore containing lead and zinc from a 300,000 ton deposit at Um Gheig on the Red Sea coast. Only a small quantity of lead can be produced by smelting this ore. If the lead is extracted in larger quantities without exploiting the zinc, the process becomes uneconomical. The Five-Year Plan recommends that output of this mine be increased from an average annual output of 2,500 tons to 30,000 tons in conjunction with the erection of a 4,000-ton-capacity zinc plant in Suez.

Safaga Phosphate Co. is planning to increase annual production to 120,000 tons by 1960, compared to a range of 70,000 to 90,000 tons during the past five years. As with other mining or milling projects the Safaga expansion is to be backed by Russia under the Five-Year Plan.

A team of six Japanese geologists, representing four large mining companies, including Mitsubishi and Mitsui, finished examination of 43 mines in various parts of Iran early in 1958. The group report, recently released in Iran, stressed lead mines and showed secondary interest in lead-zinc, chromite, and copper mines. Of the 53 mines examined, two with lead and zinc appear to be commercially attractive, and a large ore sample was sent to Japan for testing. It is reported that if the tests prove saisfactory, the Japanese will contribute financial and technical support in exploiting the deposits.

B-430

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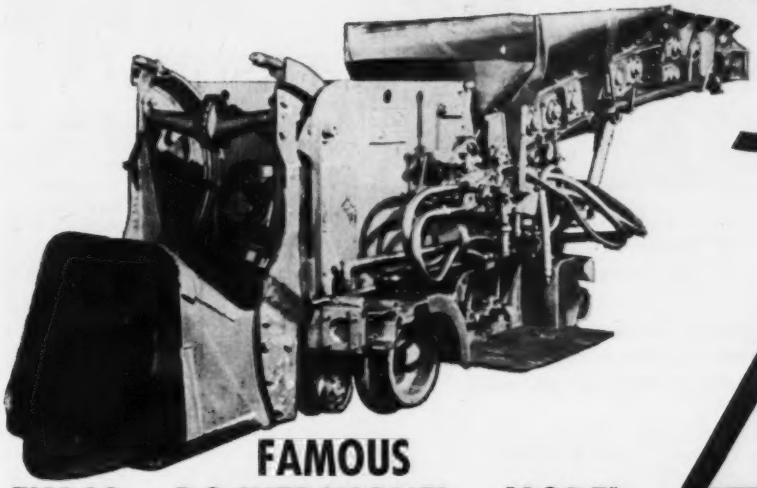

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by H. E. Bush,
mining engineer
Newport Beach, Calif.

PERSONALS

Maurice F. Dufour has been elected executive vice president and a director of Freeport Nickel Co., according to an announcement by **Robert C. Hills,** president.

Dufour

Dufour is also a vice president of Freeport Sulphur Co., the parent firm, and is in charge of construction of its $119-million nickel-cobalt project scheduled to be in production later this year.

New officers were also named for Moa Bay Mining Co., the wholly owned subsidiary of Freeport Nickel which will operate the Cuban mine and concentrating plant. **Richard V. Colligan** was named president and a director of Mobaco; **Balfour F. Darnell,** vice president and general manager; **Robert L. James,** vice president—legal; **Rudolph E. Kruger,** vice president—finance; and **Daniel W. Machon,** vice president—administrative.

W. Roy Dunbar, mining and geological consultant, Toronto, Canada, recently visited the Alliheis copper mining area, Ireland.

Richard H. Lewin was recently appointed vice president of the Cerro de Pasco Corp. in charge of domestic nonferrous metal fabricating operations. He was formerly president of the corporation's Lewin-Mathes Co. Div.

Frederick R. Strasser was made vice president of Quebec Cartier Mining Co., according to president **L. J. Severson.**

Mr. Strasser is a graduate of the University of Nebraska and of the Michigan Law School. Prior to his promotion, he was comptroller of the firm.

Dr. Armine F. Banfield, Behre Dolbear & Co., has returned from Teheran after completing a report on the mineral reconnaissance of a 47,000-sq mile area in the Kerman region of southern Iran.

Robert M. Reckeweg has been named executive vice president and general manager of Canadian Aero Service Ltd.,

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The Varian M-49 provides a maximum of magnetic data in a minimum of field time

The data is read off as an absolute value without further computation

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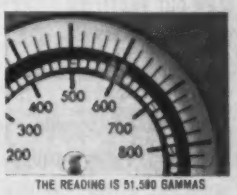

THE READING IS 51,590 GAMMAS

The Varian M-49 reveals variations in earth's magnetic field associated with faults and other subsurface structures, magnetic ore bodies, and magnetic phenomena coexistent with nonmagnetic ores. Exploration parties may now acquire magnetic data with great ease. It takes negligible extra time beyond that required for their other observations. Correlating these magnetic data with other measurements and observations can reveal interrelations that will greatly assist the geophysical interpretation.

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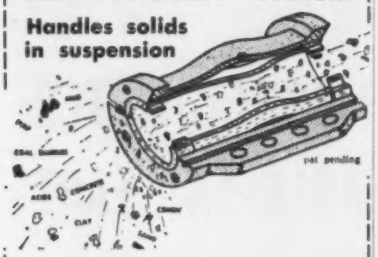

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Personals *(Continued)*

Ottawa. He has been associated with the company since it was founded in 1950.

Thomas E. Rowlands became vice president in charge of the company's engineering. He was formerly with the Geological Survey of Canada and the National Research Council.

John W. Strath is the new vice president in charge of sales and **Grant F. Ray** was named secretary and assistant treasurer of the company.

American Smelting & Refining Co.'s board of directors have elected **Robert D. Bradford** and **Edward McL. Tittmann** to be executive vice presidents of the company and have chosen **Charles F. Barber** and **Forrest G. Hamrick** to be

Tittmann

Bradford

vice presidents.

Bradford joined Asarco as a junior metallurgist in 1926, became a vice president in 1952 and a director in 1957. He is presently the president of Lake Asbestos of Quebec, Ltd., Asarco's wholly owned asbestos producing subsidiary, and is in charge of the firm's Federated Metals Div.

Tittmann came to the firm as a chemist in 1929 and served principally in the western states as manager of various Asarco plants. In 1952, he succeeded Mr. Bradford as general manager of the Western Smelting & Refining Dept. Mr. Tittman left Asarco to become president of Southern Peru Copper Corp., but returned in 1948 as vice president in charge of smelting and refining.

Before coming to Asarco, Mr. Barber was assistant to the Solicitor General of the United States. From 1948 to 1954, he was associated with the Washington, D.C. law firm of Covington & Burling.

Barber

Hamrick

Mr. Hamrick was associated with Guaranty Trust Co., and the investment counsel firm of Scudder, Stevens & Clark before joining the Washington organization which later became the War Production Board. He then served in the Navy, left in 1946 with the rank of Lt. Cmdr., and came to Asarco as a financial and economic analyst.

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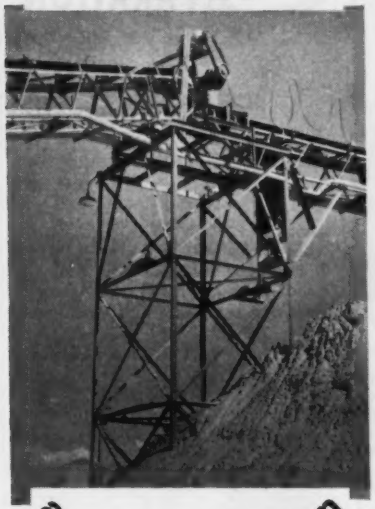

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Personals *(Continued)*

Department of Interior's Distinguished Service award and gold medal were given to Bureau director **Marling J. Ankeny** and **Earle P. Shoub,** regional director of the Bureau's Region V. At the same time, the same awards were given posthumously to **Dr. Irving Hartmann,** who, until his death last February, was chief of the branch of dust explosions at the Bureau's Pittsburgh research center.

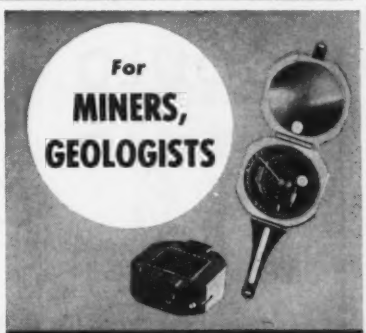
Evan Just, mining engineer and geologist who now heads the International Drilling & Water Co., Inc., will become a professor and head of Stanford University's department of mineral engineering.

Just

Just was previously vice president of Cyprus Mines Corp., and, for nearly 10 years, was editor of *E&MJ*. He went on leave from *E&MJ* in 1947-48 to serve as director of ECA's strategic materials division.

Mr. Just once taught geology at Lehigh University and at New Mexico School of Mines, and, in 1953, was awarded the honorary degree of doctor of engineering from the Montana School of Mines.

Paul A. Filteau has been made director



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Personals *(Continued)*

of public relations of Quebec Cartier Mining Co., according to president **L. J. Severson.**

Filteau was formerly the public relations supervisor for Canadian Johns-Mansville.

Lyman H. Hart, chief geologist of the American Smelting & Refining Co. for the last 13 years, will become consulting engineer for Guggenheim Brothers, **Harry F. Guggenheim,** senior partner, recently announced.

Hart

Hart will be in charge of exploration, for the firm. He was resident and exploration geologist for the Anaconda Copper Mining Co. from 1925 to 1940, when he joined the U.S. Smelting, Refining & Mining Co. as manager of exploration, serving in that capacity for six years. In 1946 he became Asarco's chief geologist.

Hart has served on the board of directors of the Society of Mining Engineers since 1947 and is presently chairman of its mining and exploration division. He is also a member of the Mining & Metallurgical Society of America; the Society of Economic Geologists; the Geological Society of America and the Mining Club of New York.

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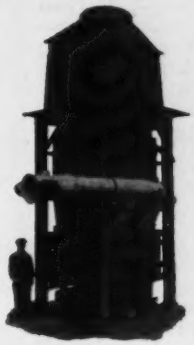

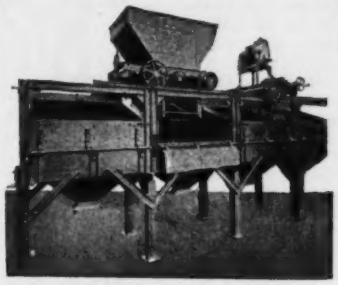

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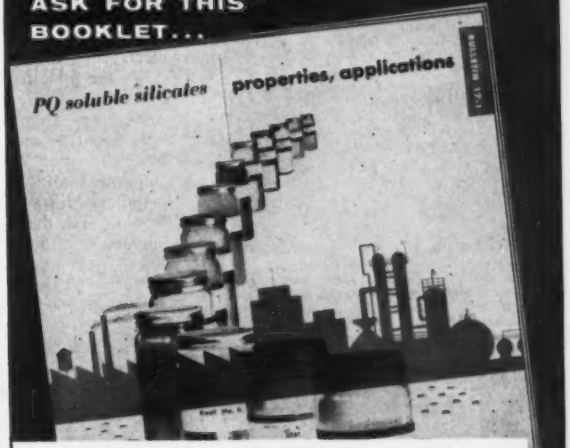

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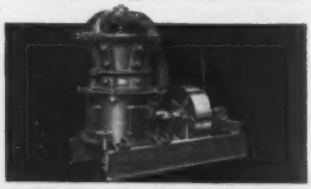
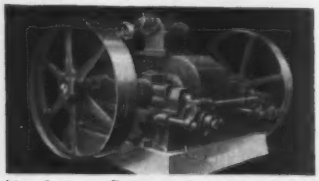
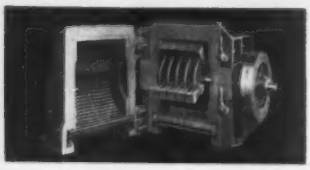


Rotary Fine Crusher — Reduce soft to medium hard 3 to 8 in. material down to ¼ to 1¼ in. sizes. Capacities up to 30 tph. Smallest model has 6 x 18 in. hopper opening; largest, 10 x 30 in. Non-clogging operation. Single handwheel regulates size. *Request Bulletin No. 063.*



Crushing Rolls — Reduce soft to hard 2 in. and smaller materials to from 12 to 20 mesh with minimum fines. Eight sizes, with rolls from 8 x 5 in. to 38 x 20 in.; rates to 87 tph. Three types — Balanced Rolls; Plain Balanced Rolls; Laboratory Rolls — all may be adjusted in operation. *Request Bulletin No. 065.*



Hammer Mills — Reduce to 20 mesh. Swing-Sledge Mills crush or shred medium hard material up to 70 tph. Hinged-Hammer Pulverizers crush or shred softer material at rates up to 30 tph. Four Swing-Sledge Mills with feed openings from 6 x 5 in. to 20 x 30½ in. Four Hinged-Hammer Pulverizers with feed openings from 12 x 12 in. to 12½ x 24 in. *Request Bulletin No. 084.*

**Reports Manager W. Carleton Merrill concerning Sturtevant Swing-Sledge Mill at James F. Morse Co., Boston.*

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101 Clayton St., Boston 22, Mass.

Personals *(Continued)*

Frank F. Russell, chairman of the board of Cerro de Pasco Corp., was elected president of the Peruvian-American Association, Inc., succeeding **R. F. Goodwin,** chairman of the executive committee of Southern Peru Copper Corp. Mr. Russell previously served as a vice president of the association.

OBITUARIES

Niel R. Allen, 64, attorney and member of the Oregon State Board of Geology and Mineral Industries from 1946 to 1952, died April 13 at Grants Pass.

Stuart A. Falconer, 60, chief metallurgist for the American Cyanamid Co., died April 25 at Darien, Conn.

Mr. Falconer graduated from the University of British Columbia in 1924 and had been with American Cyanamid since 1927.

Marvin J. Udy, 67, vice president and consultant for Strategic-Udy Processes, Inc., and developer of the first commercial process for the refining and utilization of chromium, died April 11 at Niagara Falls, N.Y.

Udy

Mr. Udy developed and patented a process for the recovery of bismuth from the ores of Leadville, Colo., while on the staff of the United States Mining, Smelting & Refining Co., Midvale, Utah from 1916 to 1918. Later he worked for the Hooker Electrochemical Co. on the use of chlorine in the metallurgy of nonferrous ores, and with O. C. Ralston, developed a method of separating nickel and cobalt using chlorine and calcium carbonate.

Shortly after WW I he developed the cadmium plating process which resulted in the establishment of the Udylite Process Co., and, during the same period, he patented a process for the recovery of cobalt by electrodeposition.

From 1920 to 1931, Udy was a research and development engineer with Union Carbide laboratories and the Electro Metallurgical Co., and spent several years in studying the electrodeposition of chromium and chromium plating.

Dr. Udy (honorary degree from Alfred University in 1956) also helped develop exothermic chromium, manganese, and silicon processes and an improved process for winning nickel from low grade ores.

Dr. Udy was a member of the AIME and many other technical societies. He was also a former president of the Electrochemical Society.

Hans Tzschaschel, 48, manager of Norddeutsche Affinerie, died at Hamburg, Germany on May 3, following a severe illness.

Oscar L. Cash, former mine superintendent for Bradley Mining Co., died in Reno on March 4.

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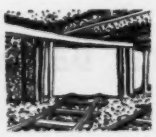

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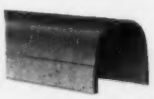

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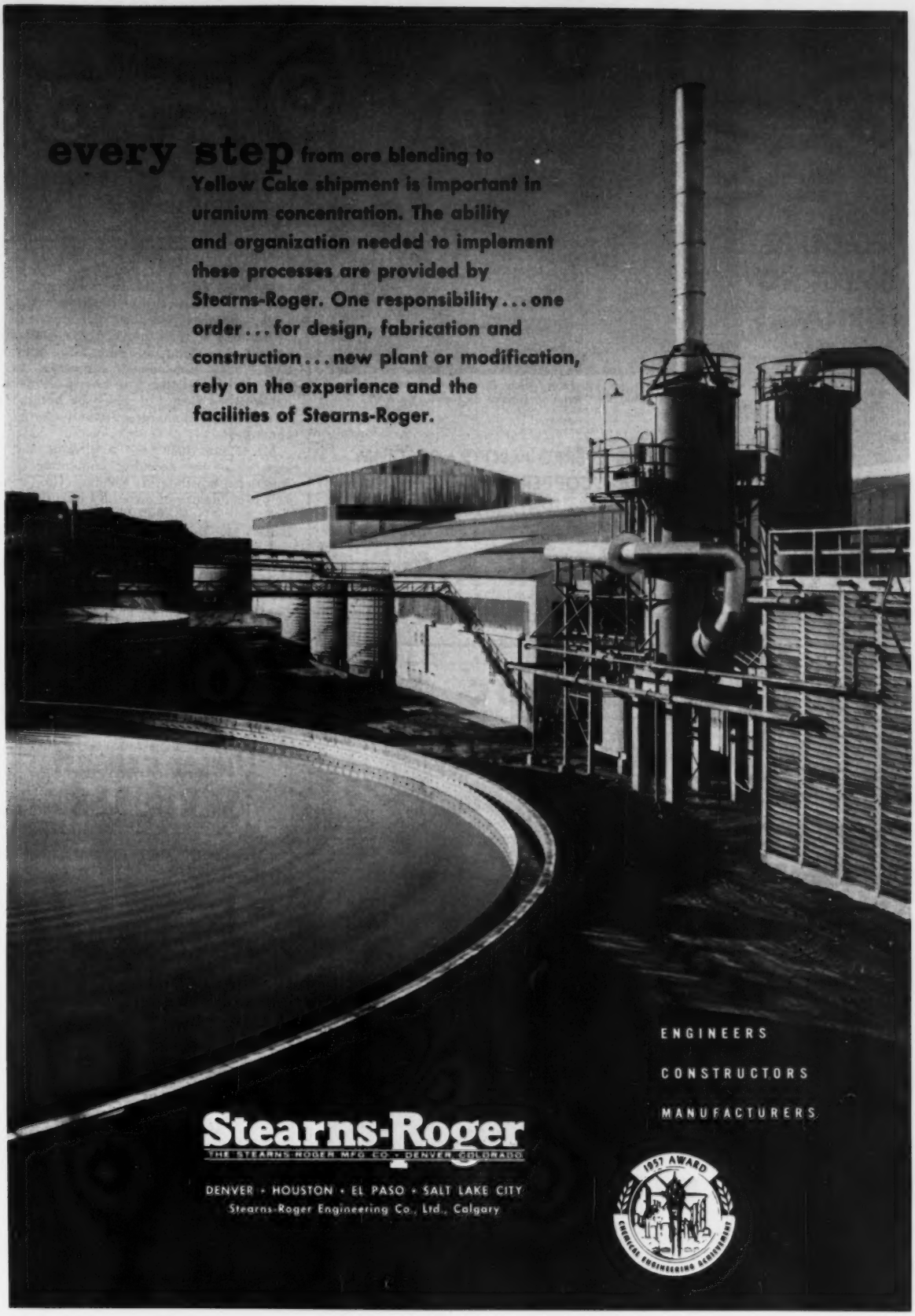
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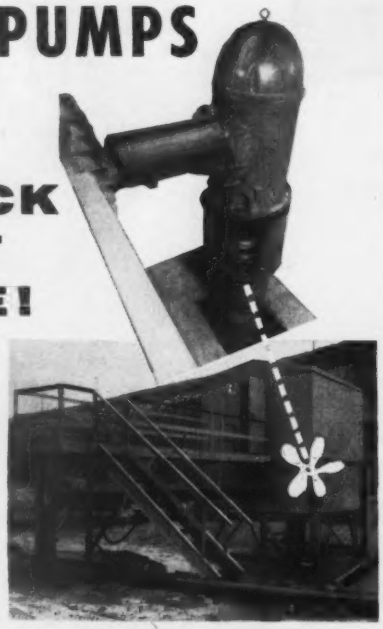

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He had been with Bradley for 20 years before retiring in the 1940's. He specialized in quicksilver and went to Nevada from Texas for the company in the 1920's and became in succession superintendent of the Ione quicksilver mine in Nevada and the Opalite and Bretz in Oregon.

C. Donald Dallas, 77, president of Revere Copper & Brass Inc. from 1931 to 1947 and its board chairman and chief executive officer from 1947 to 1951, died April 11 at Sarasota, Fla.

In 1908, Dallas and his father organized the Dallas Brass & Copper Co. Dallas became president and treasurer of the firm in 1918. In 1928, Mr. Dallas merged his company with five other large brass and copper companies to form a consolidation first known as Republic Brass Corp., of which he became vice president in charge of manufacturing and sales.

Mr. Dallas had been a director and member of the executive committee of American Smelting & Refining Co., as well as a director of General Cable Corp.

Edgar M. Barker, 50, vice president and charge of production at Calaveras Cement, San Francisco, died March 19 in Honolulu.

Mr. Barker was also president of Calco Supply, a wholly-owned Calaveras subsidiary.

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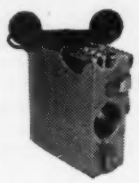

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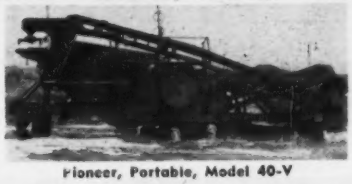

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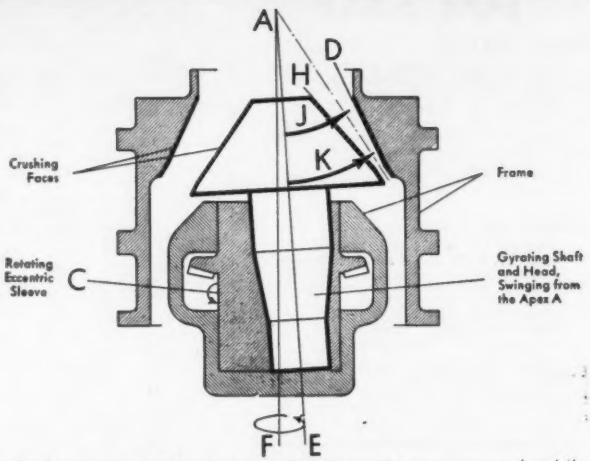

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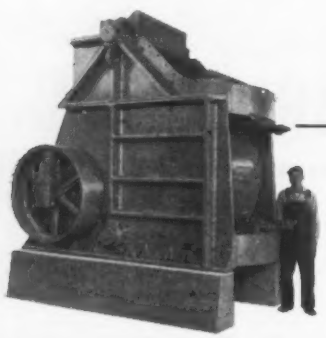

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New Jersey, Newark 4: 165 Oraton St.
Pennsylvania, Pittsburgh 18: 2437 Waverly St., Swissvale
Texas, Houston 3: 2201 Dallas Ave.

Amercoat Corp., 4809 Firestone Blvd., South Gate, Calif.

American Air Filter Co., Inc., 215 Central Ave., Louisville 8, Ky.
Arizona, Phoenix: 4808 North 7th Ave.
California, Los Angeles, 42: 6181 York Blvd.
California, San Francisco, 3: 460 9th St.
Colorado, Denver, 2: 2415—15th St.
Minnesota, Duluth, 2: Alsworth Bldg.
Utah, Salt Lake City, 1: 44 W. 8th South St.
Canada, Ontario, Toronto, 18: 3355A Bloor Street West
Canada, Quebec, Montreal, 9: 400 Stinson Blvd.

American Brattice Cloth Corp., Argonne Road, Warsaw, Ind.

Ohio, Cleveland: 1313 West 11th St.

American Cyanamid Co., Bound Brook, N. J.
Alabama, Bessemer
Colorado, Denver: 1455 Kearney St.
Missouri, St. Louis: 5025 Pattison Ave.
Pennsylvania, Latrobe: P. O. Box 270
Pennsylvania, Pottsville: 209 North 19th St.
Pennsylvania, Scranton
Texas, El Paso: 3001 Memphis St.
Utah, Salt Lake City
West Virginia, Bluefield
Washington, Spokane: West 242 Riverside Ave.

American Hoist & Derrick Co., 63 South Robert St., St. Paul 7, Minn.
California, Berkeley 7: 674 Santa Rosa
California, Burlingame: 1300 Montero
Georgia, Atlanta 19: 2718 Osborne Road N. E.
Illinois, LaGrange: Unit No. 7, 905 West Hillgrove Ave.
Iowa, Des Moines: 2024—39th St.
Michigan, Detroit 19: 9130 West Outer Dr.
Minnesota, Minneapolis: 4152 Park Ave.
New Jersey, South Kearny: Foot of Jacobus Ave.
Pennsylvania, Blue Bell: Stony Brook Dr.
Pennsylvania, Pittsburgh 22: 1 Cedar Blvd., Room 112
Texas, Dallas: 6339 Woodland Dr.
Texas, Houston 25: 3650 Glen Haven St.
Washington, Seattle: 4975—3rd Ave. South

American Metal Climax Co., 500 Fifth Ave., New York 36, N. Y.

American Mine Door Co., 2039 Dueber Ave., S. W., Canton 6, Ohio

American Pulley Co., 4200 Wissahickon Avenue, Philadelphia 29, Pa.
California, Los Angeles: 1940 S. Figueroa St.
Georgia, Decatur: 2968 San Jose Dr.
Illinois, La Grange: 312 S. Park St.
Illinois, Park Forest: 270 Minocqua St.
Massachusetts, Worcester 2: 926 Pleasant St.
Michigan, Birmingham: 1130 Stanley Ave.
Minnesota, Minneapolis: 3651 Cedar Ave.
Missouri, Dittmer: Ridge Rd., Cedar Hill, R. D. 1
New York, New York 17: 70 E. 45th St.
North Carolina, Charlotte 7: 2015 Hopedale Ave.
Pennsylvania, Fountainville: Bucks County
Pennsylvania, Pittsburgh: 992 Perry Highway
Texas, Dallas: Box 8026
Washington, Seattle: 3628 E. Marginal Way

American Smelting & Refining Co., 120 Broadway, New York 5, N. Y

American Steel Foundries, Prudential Plaza, Chicago 1, Ill.
Indiana, East Chicago: 3761 Canal St.

American Steel & Wire Div., U.S. Steel Corp., Rockefeller Bldg., Cleveland, Ohio

Anaconda Wire and Cable Co., 25 Broadway, New York 4, N. Y.
California, Los Angeles 17: 807 Douglas Oil Bldg.
California, San Francisco 4: Room 2375, 120 Montgomery St.
Colorado, Denver 2: Room 706, Railway Exchange Bldg., 909 Seventeenth St.
Illinois, Chicago 6: 20 North Wacker Dr.
Louisiana, New Orleans 19: 240 Caribe Bldg.
Massachusetts, Cambridge 42: Kendall Square Bldg., 238 Main St.
Michigan, Detroit 2: 621 New Center Bldg.
Minnesota, Minneapolis 2: Room 1715 Foshay Tower, 821 Marquette Ave.
Missouri, St. Louis 8: 1705 Continental Bldg., 3615 Olive St.
New York, New York 6: Room 2611-12, 21 West St.
North Carolina, Charlotte 2: 213 Wilder Bldg.
Pennsylvania, Philadelphia 3: Room 10 1616 Walnut St. Bldg.
Pennsylvania, Pittsburgh 22: 1526 Bldg. No. 3, Gateway enter
Texas, Dallas 1: 1201 Fidelity Union Life Bldg., 1511 Bryan St.
Washington, Seattle 1: 954 Stuart Bldg., Metropolitan Center
West Virginia, Charleston 1: 501, 503, 505 Peoples' Bldg.
Wisconsin, Milwaukee 3: Room 368 Bocki Bldg., 2040 West Wisconsin

Armour Chemical Div., 110 North Wacker (As of July 1), Chicago, Ill.
Georgia, Atlanta 5: 3127 Maple Dr. N. E.
North Carolina, Charlotte 8: 2000 Thrift Rd.
Texas, Midland: 139 Allen Bldg.

Asea Electric Inc., 500 Fifth Ave., New York 36, N. Y.

Athey Products Corp., 5631 W. 65th St., Chicago 38, Ill.

Atlas Car & Mfg. Co., 1140 Ivanhoe Rd., Cleveland 10, Ohio

Atlas Copco Eastern, Inc., 610 Industrial Avenue, Paramus, N. J.

Atlas Copco Pacific, Inc., 930 Brittain Ave., San Carlos, Calif.
Arizona, Phoenix: 1326 N. 22nd Ave.
Colorado, Denver: 2360 S. Delaware St.
Utah, Salt Lake City 4: 1065 South Second West St.
Washington, Spokane 43: 1509 West Second St.

Atlas Powder Co., Wilmington 99, Del.
California, San Francisco 4: Crocker First National Bank Bldg., 1 Montgomery St.
Delaware, Wilmington 99
Illinois, Chicago 3: 1606 Field Bldg., 135 S. LaSalle St.
Missouri, Joplin: 612 First National Bldg.
Pennsylvania, Pittsburgh 22: 1544 Oliver Bldg.
Tennessee, Knoxville 3: Hamilton National Bank Bldg.
Washington, Seattle 1: 1320 Joseph Vance Bldg.

Austin-Western, Construction Equipment Div., Baldwin-Lima-Hamilton Corp., Aurora, Ill.

Autocar Div., The White Motor Co., Exton, Pa.
Alabama, Birmingham 3: 1701 3rd Ave., South
California, Los Angeles 15: 400 E. Washington Blvd.
California, San Francisco 7: 590 Brannan St.

Colorado, Denver 5: 1910 38th St.
Georgia, Atlanta 7: 70 Boulevard, N. E.
Illinois, Chicago 16: 2401 Archer Ave.
Illinois, Chicago Northside: 6421 W. Fullerton Ave.
Indiana, Indianapolis 2: 1400 N. Senate Ave.
Kentucky, Louisville 2: 804 S. 5th St.
Louisiana, New Orleans 13: S. Claiborne at Earhart Blvd.
Maryland, Baltimore 18: 708-728 E. 25th St.
Massachusetts, Boston 15: 930 Commonwealth Ave.
Michigan, Detroit 16: 2950 Twelfth St.
Minnesota, Minneapolis 14: 2812 University Ave., S. E.
Missouri, Kansas City 6: 522 Locust St. Trafficway
Missouri, St. Louis 6: 1415 N. 13th St.
Nebraska, Omaha 2: 20th & Leavenworth St.
New Jersey, Newark 5: 190 Murray St.
New York, Albany 4: 460 N. Pearl St.
New York, Buffalo 4: 85 Michigan Ave.
New York, New York 17: 415 Madison Ave.
New York, New York 36: 547 W. 47th St.
North Carolina, Charlotte 8: 1514 W. Morehead St.
Ohio, Akron 6: 1250 Triplett Blvd.
Ohio, Cincinnati 6: 2230 Gilbert Ave.
Ohio, Cleveland 1: 1421 E. 49th St.
Oklahoma, Oklahoma City: 1001 S. W. 3rd St.
Oregon, Portland 10: 2705 N. W. Nicolai St.
Pennsylvania, Philadelphia 32: 34th & Indiana Ave.
Pennsylvania, Pittsburgh 33: 1136 Western Ave.
Texas, Dallas 1: 2000 S. Ervay St.
Texas, Dallas 35: 431 Exchange Park Bldg.
Texas, Fort Worth 1: 825 W. Vickery Blvd.
Texas, Houston 1: 4720 Gulf Freeway
Wisconsin, Milwaukee 3: 2440 W. Clybourn St.
Canada, Toronto, Ontario: The White Motor Company of Canada, Ltd., 1041 The Queensway

Babcock & Wilcox Co., 161 East 42nd St., New York 17, N. Y.
Georgia, Atlanta 3: Candler Bldg.
Illinois, Chicago 3: 105 S. LaSalle St.
Massachusetts, Boston 10: 140 Federal St.
Michigan, Detroit 26: Ford Bldg.
Minnesota, Minneapolis 2: Northwest Bank Bldg.
Missouri, Kansas City 6: 1012 Baltimore Ave.
Missouri, St. Louis 3: Shell Bldg.
New York, Syracuse 2: State Tower Bldg.
North Carolina, Charlotte 2: Wachovia Bank Bldg.
Ohio, Cincinnati 2: Carew Tower
Ohio, Cleveland 13: Illuminating Bldg.
Pennsylvania, Philadelphia 2: 3 Penn Center
Pennsylvania, Pittsburgh 19: Koppers Bldg.

Baldwin-Lima-Hamilton Corp., Philadelphia National Bank Building, Philadelphia 7, Pa.
California, Los Angeles 17: 600 St. Paul Ave.
California, San Francisco 10: 2929 19th St.
D. C., Washington 6: 1000 Connecticut Ave., N. W.
Illinois, Chicago 4: 627 Railway Exchange Bldg.
Michigan, Detroit 34: 8345 Lynch Rd.
Missouri, St. Louis 3: 1221 Locust St.
New York, New York 3: 111 Fifth Ave.
New York, Schenectady: 509 State St.
Pennsylvania, Philadelphia 42
Pennsylvania, Pittsburgh 19: 1098 Union Trust Bldg.
Texas, Dallas 7: 2356 Irving Blvd.

Ball Brothers Research, Industrial Park, Boulder, Colo.

Barber-Greene Company, 400 North Highland Ave., Aurora, Ill.
Alabama, Birmingham: 512 North 18th St.
California, San Mateo: 2191 South El Camino Real
California, Whittier: 1402 West Hadley St.
Florida, Orlando: 711 Magnolia Ave.
Illinois, Chicago 6: 9 South Clinton St.
Massachusetts, Needham Heights 94: 57 Crawford St., P. O. Box 105
Minnesota, Minneapolis: 5605 Lyndale Ave., South
New York, New York 17: 441 Lexington Ave.
New York, Syracuse 2: 218 Harrison St.
Texas, Dallas 6: 4515 Prentice St.

Bemis Bro. Bag Company, 408 E. Pine St., St. Louis 2, Mo.
Alabama, Mobile 6: P. O. Box 1110
Arizona, Phoenix: P. O. Box 6504
California, San Francisco 26: 1000 Sansome St.
California, Wilmington: 920 East Pacific Coast Hwy.
Colorado, Denver 2: 426 Guaranty Bank Bldg.
Idaho, Boise: 202 McCarty Bldg.
Illinois, Chicago 3: 120 S. LaSalle St.
Indiana, Indianapolis: 1940 Barth Ave.
Kansas Salina: 730 N. 9th St.
Kansas, Wichita 1: P. O. Box 1482
Louisiana, New Orleans 12: 330 Notre Dame St.
Maryland, Baltimore 10: 312-A Wyndhurst Ave.
Massachusetts, Boston 9: 40 Central St.
Michigan, Detroit 27: 12736 Fenkell Ave.
Minnesota, Minneapolis 15: 600 Fourth St., South
Missouri, Kansas City 1: 925 Wyoming St.
Missouri, St. Louis 2: 601 South 4th St.
Nebraska, Omaha 8: 618 South 11th St.
New York, Brooklyn 1: 26 Court St.
New York, Buffalo 5: P. O. Box 118
New York, New York 17: 60 East 42nd Ave.
North Carolina, Charlotte 5: 2008 Commonwealth Ave.
Ohio, Cleveland 13: 2012 West 25th St.
Oklahoma, Oklahoma City: 502 Commerce Exchange Bldg.
Tennessee, Memphis: P. O. Box 2566, De Soto Station
Texas, Houston 1: P. O. Box 1228
Utah, Salt Lake City 1: 1101 Walker Bank Bldg.
Virginia, Norfolk 8: 1037 West 26th St.
Washington, Seattle 4: 65 Atlantic St.
Washington, Vancouver: 1401 West 26th St.

Bethlehem Steel Co., Bethlehem, Pa.
California, Los Angeles 54: Box 2057 Terminal Annex
California, San Francisco 19: 20th & Illinois Sts.
Canada, Montreal: Dominion Square Bldg.
Canada, Toronto: 170 University Ave.
Georgia, Atlanta 1: 1312 Fulton Nat'l Bank Bldg., 55 Marietta St.
Illinois, Chicago 1: 2700 Prudential Bldg., Prudential Plaza
Illinois, Herrin: 500 W. Monroe St.
Kentucky, Louisville 6: 3321 Trinity Rd.
Maryland, Baltimore 3: 300 St. Paul Place
Massachusetts, Boston 10: 75 Federal St.
Michigan, Detroit 2: General Motors Bldg., 3044 West Grand Blvd.
Minnesota, St. Paul 1: First Nat'l Bank Bldg., 335 Robert St.
Missouri, St. Louis 5: 212 So. Central Ave.
New York, Albany 7: 90 State St.
New York, Buffalo 2: 1515 Liberty Bank Bldg., 424 Main St.
New York, New York 2: 375 Park Ave.
Ohio, Cincinnati 2 1401 Fifth Third Bank Bldg., 4th & Walnut Sts.
Ohio, Cleveland 13: 2700 Terminal Tower, 50 Public Square
Oregon, Portland 5: 1010 S. W. Fourteenth Ave.
Pennsylvania, Johnstown: Bethlehem Bldg., 119 Walnut St.
Pennsylvania, Philadelphia 3: 1058 Suburban Sta. Bldg., 1617 Penna. Blvd.
Pennsylvania, Pittsburgh 22: 1200 Oliver Bldg., Mellon Square
Texas, Houston 1, 7100 Clinton Dr.
Washington, Seattle 4: 3651 E. Marginal Way
West Virginia, Bluefield: 2415 Bland Rd.
West Virginia, Charleston: One Morris Apts., 1 Morris St.

Birdsboro Steel Foundry and Machine Co., Birdsboro, Pa.

Blaw-Knox Co., Equipment Div., P. O. Box 30, Pittsburgh, Pa.
Alabama, Birmingham: Brown-Marx Bldg.
New Jersey, Haddon Heights: Black Horse Pike & High St.

Boston Woven Hose & Rubber Co., Division of American Biltrite Rubber Co., Inc., P. O. Box 1071, Boston 3, Mass.
Alabama, Birmingham: P. O. Box 1816
California, Los Angeles 34: 3832 Cardiff Ave.
California, San Francisco 3: 1355 Market St.
Colorado, Denver 4: 710 West Colfax Ave.
Georgia, Atlanta: 3508 Woods Dr., Decatur, Ga.
Illinois, Chicago: 2651 Gardner Rd., Broadview, Ill.
Kentucky, Louisville 17: P. O. Box 32, Shelby Station
Minnesota, Minneapolis 2: 1002 Baker Bldg.
Missouri, Kansas City 5: 20 West 9th Street Bldg.
Missouri, St. Louis 9: 3531 Lawn Ave.
New York, New York 7: 30 Church St.
Ohio, Cleveland 30: 7586 Webster Rd.
Utah, Salt Lake City 5: 1016 Military Dr.
Virginia, Richmond: P. O. Box 1012
Washington, Seattle 4: 911 Western Ave.

Boyles Bros. Drilling Co. Ltd., Vancouver, Canada

Broderick & Bascom Rope Co., 4203 Union Blvd., St. Louis 15, Mo.

Brunner & Lay, Inc., 9300 King St., Franklin Park, Ill.
Alabama, Birmingham: 5 18th St., S. W.
California, Los Angeles: 2425 E. 37th St.
California, Sacramento: 7500 14th Ave.
Colorado, Denver: 2 Santa Fe Dr.
Massachusetts, Dorchester: 203 Victory Rd.
New Mexico, Albuquerque: 2224 Broadway, S. E.
North Carolina, Asheville: Sweeten Creek Rd.
Oregon, Portland: 600 N. Tillamook St.
Pennsylvania, Philadelphia: 2514 E. Cumberland St.
Texas, Dallas: 150 Leslie St.
Washington, Seattle: 2600 1st Ave. & Vine
Washington, Yardley: 5311 E. Railroad Ave.
Canada, Lachine, P. Q.: 2280—43rd Ave.
Canada, Vancouver, B. C.: 1230 Seymour St.

Bucyrus-Erie Co., South Milwaukee, Wisc.
California, Los Angeles 14: 308 Security Title Insurance Bldg., 530 West Sixth St.
California, South San Francisco: 120 Freeway St.
Georgia, Atlanta 3: 1508 William-Oliver Bldg.
Illinois, Chicago 3: 3100 Bankers Bldg., 105 West Adams St.
Missouri, Kansas City 12: Room 201, 424 Nichols Rd.
New York, New York 30: Suite 5050, 30 Rockefeller Plaza
Pennsylvania, Pittsburgh 22: Room 958, 2 Gateway Center
Texas, Dallas 1: 606 Tower Petroleum Bldg.
Washington, Seattle 1: 4447 White-Henry-Stuart Bldg.

Buell Engineering Co., 123 William St., New York 38, N. Y.

Card Iron Works, C. S., 2501 West 16th Ave., Denver 4, Colo.

Case Co., J. I., Industrial Div., 700 State St., Racine, Wisc.

Caterpillar Tractor Co., Peoria, Ill.

Cheatham Electric Switching Device Co., 4780 Crittenden Drive, Louisville 9, Ky.
Utah: Salt Lake City: 375 South West Temple

Chevrolet Motors Div., General Motors Corp., Detroit 2, Mich.

Chicago Pneumatic Tool Co., 6 East 44th St., New York 17, N. Y.
Alabama, Birmingham: 810 Fifth Ave. North
Colorado, Denver 4: 465 Acoma St.
Illinois, Chicago 19: 936 East 87th St.
Missouri, St. Louis 3: 1931 Washington Ave.
Ohio, Cincinnati: 4511 Reading Rd.
Ohio, Cleveland: 1643 Superior Ave.
Pennsylvania, Pittsburgh 13: 369 Coltart St.
Pennsylvania, Wynnewood: 312 E. Lancaster Ave.
Utah, Salt Lake City 1: 156 West Fourth South
Washington, Seattle 4: 2901 First Ave. South

Christensen Diamond Products Co., 1937 South 2nd West, Salt Lake City 10, Utah

Clark Equipment Co., Construction Equipment Div., 2465 Pipestone Rd., Benton Harbor 40, Mich.

Coates Steel Products Co., Greenville, Ill.

The Colorado Fuel and Iron Corp., Continental Oil Building, Denver 2, Colo.
Arizona, Phoenix: 201 S. 28th St., P. O. Box 12036
California, Los Angeles 22: 2444 Saybrook Ave.
California, Oakland 6: 1080 19th Ave., P. O. Box 270
California, San Francisco 3: 357-58 Russ Bldg., 235 Montgomery St.
California, San Leandro: 425 Hester St.
Colorado, Denver: 4950 Colorado Blvd.
Colorado, Pueblo: P. O. Box 316
Idaho, Boise: P. O. Box 1552
Illinois, Chicago 32: 3838 W. 51st St.
Georgia, Atlanta: 934 Avon Ave., S. W.
Kansas, Wichita 5: 811 E. 10th St.
Louisiana, New Orleans 18: 1128 Dublin St., P. O. Box 4114
Massachusetts, Boston 10: 80 Federal St.
Michigan, Detroit 26: 1915 Nat'l Bank Bldg.
Missouri, Kansas City, North: 2330 Burlington Ave.
Montana, Billings: 501 N. 27th St., P. O. Box 1763
Montana, Butte: 401-402 Metals Bank Bldg.
Nebraska, Lincoln 8: 404-405 Sharp Bldg.
New Mexico, Albuquerque: 2824 Central Ave., S. E.
New York, Buffalo 2: 361 Delaware Ave.
New York, New York 22: 575 Madison Ave.
Oklahoma, Oklahoma City 2: 916 Colcord Bldg.
Oregon, Portland 10: 3150 N. W. 31st Ave.
Pennsylvania, Philadelphia 40: 225 W. Erie Ave.
Texas, Amarillo: 1008 Fisk Bldg., P. O. Box 2371
Texas, El Paso: 803-5 Basset Tower Bldg., P. O. Box 2006
Texas, Ft. Worth 2: 2413 Continental National Bank Bldg.
Texas, Houston 11: 6609 Supply Row, P. O. Box 9367
Utah, Salt Lake City 4: 212 W. 13th South St., P. O. Box 1738
Washington, Seattle 4: 3434-44 2nd Ave. S.
Washington, Spokane 6: 4320 E. Trent Ave.

Connellsville Manufacturing and Mine Supply Co., S. Fourth St., P. O. Box 677, Connellsville, Pa.
Alabama, Birmingham 3: 2213 Sixth Ave., South

Construction Equipment Div., Baldwin-Lima-Hamilton Corp., Lima, Ohio
California, La Mirada: 14120 E. Rosecrans Ave.
Georgia, Atlanta: 1503 Northside Dr.
Minnesota, Minneapolis: 1611 Foshay Tower
Texas, Dallas: 2356 Irving Blvd.
Washington, Seattle 4: 1932 First Avenue So.

Coppus Engineering Corp., Worcester 10, Mass.
Crane Co., 836 S. Michigan Avenue, Chicago, Ill.
Alabama, Birmingham 3: 2 S. 20th St.
Arizona, Phoenix: 233 S. First Ave.
Arizona, Tucson: 35 E. Toole Ave.
Arkansas, Little Rock: 1000 E. 2nd St.
California, Los Angeles 54: 321 E. Third St.
California, Oakland 7: 346 9th St.
California, Sacramento 5: 1227 Front St.
California, Salinas: 239 East Alisal St.
California, San Bernardino: 777 W. Mill St.
California, San Diego 1: 1138 India St.
California, San Francisco 19: 301 Brannan St.
California, San Jose 25: 63 San Jose Ave.
California, Santa Ana: 919 Poinsettia St.
Colorado, Denver 17: 1631 15th St.

Colorado, Grand Junction: 601 Pitkin Ave.
Colorado, Pueblo: 180 Central Main
Florida, Jacksonville 4: 1007 W. Bay St.
Georgia, Atlanta 3: Washington St. Viaduct
Idaho, Pocatello: 756 S. First Ave.
Illinois, Chicago: 9234 W. Belmont Ave.
Kansas, Wichita 1: 624 E. Forst St.
Kentucky, Louisville 2: 756 S. First St.
Louisiana, New Orleans 11: 710 S. Broad St.
Louisiana, Shreveport 92: 1320 Winston St.
Minnesota Duluth 2: 102 Lake Ave. S.
Minnesota, St. Paul 1: Broadway at 5th St.
Missouri Kansas City 8: 2819 Warwick Trafficway
Missouri, St. Louis 3: 30 S. 16th St.
Montana, Billings: 30th St. and First Ave., S.
Montana, Great Falls: No. 2 Third Ave., South
Nevada, Reno: 401 E. 4th St.
New Jersey, Camden 4: 2994 Mt. Ephraim Ave.
New Mexico, Albuquerque: 612 First St., N. W.
New York, Albany 1: North Broadway
New York, New York City 17: (Display Room), 101 Park Ave.
North Carolina, Greensboro: 205 S. Lyndon St.
North Dakota, Fargo: 1441 4th Ave., North
North Dakota, Minot: Highway 2 & 52 West
Ohio, Cleveland 3: 6215 Carnegie Ave.
Oklahoma, Tulsa 2: 623 E. Third St.
Oregon, Medford: 125 West Fourth St.
Oregon, Portland 8: 710 N. W. Fourteenth Ave.
Pennsylvania, Philadelphia 22: 245 Master St.
Pennsylvania, Pittsburgh 30: 40 24th St.
South Carolina, Greenville: 223 W. McBee Ave.
South Dakota, Aberdeen: 324 Railroad Ave. E.
South Dakota, Sioux Falls: 326 E. 8th St.
Tennessee, Chattanooga 2: 1317 Chestnut St.
Tennessee, Knoxville 1: 523 Jackson Ave. N. W.
Tennessee, Memphis 1: 254 Court Ave.
Tennessee, Nashville 2: 532 8th Ave. South
Texas, Dallas 22: 814 Young St.
Texas, El Paso: 1609 Texas St.
Texas, Houston 1: 2204 Pease Ave.
Utah, Ogden: 2001 Wall Ave.
Utah, Provo: 237 West 500 North
Washington, Seattle 24: 419 2nd Ave., S.
Washington, Spokane 10: N. 207 Crestline Ave.
Wyoming, Casper 5: 802 E. "C" St., P. O. Box 1331
Canada, Alberta, Calgary: 602 11th Ave., W.
Canada, Alberta, Edmonton: 11925 Kingsway
Canada, Alberta, Lethbridge: 2815 2nd Ave. A., South
Canada, British Columbia, Vancouver 12: 3695 Grandview Highway
Canada, British Columbia, Victoria: 2001 Douglas St.
Canada, Manitoba, Winnipeg: 93 Lombard St.
Canada, New Brunswick, Fredericton: 620 King St.
Canada, Newfoundland, St. John's: Hill O'Chips, Box E-5248
Canada, Nova Scotia, Dartmouth: 22 Prince Albert Road
Canada, Ontario, Ottawa: 288 Catherine St.
Canada, Ontario, Toronto: 306 Front St., W.
Canada, Quebec, Montreal: 1121 St. James St. W.
Canada, Quebec, Quebec: 460 St. Roch St.
Canada, Saskatchewan, Regina: 1408 Broad St.
Canada, Saskatchewan, Saskatoon: 359 First Ave., N.
England, London: 15-16, Red Lion Court, Fleet St.

Crucible Steel Co. of America, Henry W. Oliver Bldg., Mellon Square, Pittsburgh 22, Pa.
California, Los Angeles 22: 6033 E. Bandini Blvd.
California, San Francisco 10: 2050 Bryant St.
Colorado, Denver 16: 6301 Colorado Blvd.
Georgia, Atlanta: 3400 Malone Dr., Chamblee
Illinois, Chicago 39: 4501-4531 W. Cortland St.
Massachusetts, Boston 54: Waltham Industrial Center, 45 1st Ave., Waltham, Mass.
Michigan, Detroit 34: 4920 E. Nevada Ave.
Missouri, St. Louis 14: 8610 Page Blvd.
Minnesota, Minneapolis 14: 2911 Como Ave., S. E.
New Jersey, Harrison: P. O. Box 28, 1000 S. Fourth St.
Oregon, Portland 10: 2330 N. W. Raleigh St.
Pennsylvania, Philadelphia: 408 S. Oak Lane, Primos
Pennsylvania, Pittsburgh 30: P. O. Box 2309
Utah, Salt Lake City: 753 W. 8th St., S., P. O. Box 1694
Washington, Seattle 4: 2755 First Ave. South
Wisconsin, Milwaukee 9: P. O. Box 6007, Station "F" 4200 West Douglas Rd.
Canada, Toronto 5, Ontario: 410 Bloor St., East

Curtiss-Wright Corp., South Bend Div., South Bend, Ind.

Colorado Fuel & Iron Corp., Wickwire Spencer Steel Div., Box 232, Palmer, Mass.
Colorado, Denver 2: 4950 Colorado Blvd.
Colorado, Pueblo: P. O. Box 316
Illinois, Chicago 32: 3838 W. 51st St.
New York, Buffalo 2: 361 Delaware Ave.
Pennsylvania, Emlenton: P. O. Box 388
Pennsylvania, Philadelphia 40: 225 West Erie Ave.
Tennessee, Chattanooga 2: First & Broad Sts.
Utah, Salt Lake City: 212 W. 13th St.

Deere & Company, 3300 River Dr., Moline, Ill.
California, San Francisco 19: Box 3573 Rincon Annex
Georgia, Chamblee: Box 4899
Illinois, Moline: 400—19th St.
Indiana, Indianapolis 7: 1025 W. Washington St.
Maryland Baltimore 18: 2524 Kirk Ave.
Michigan, Lansing 4: Box 720
Minnesota, Minneapolis 1: 800 Washington Ave. N.
Missouri, Kansas City 30: Southeast Station
Missouri, St. Louis 6: 2212-20 N. Broadway
New York, Syracuse 1: Box 585
Ohio, Columbus 8: 1573 Olentangy River Rd.
Oregon, Portland 14: 215 S. E. Morrison St.
Texas, Dallas 20: Box 13125
Canada, Alberta, Calgary: 201 Tenth Ave. East
Canada, Manitoba, Winnipeg: Box 926
Canada, Ontario, Hamilton: Box 355—Main P. O.
Canada, Saskatchewan, Regina: 7th & Broad Sts.

Deister Concentrator Co., Inc., 903 Glasgow Ave., Fort Wayne, Ind.
Alabama, Birmingham: 2612 N. 24th St.
California, Los Angeles: 2020 Sacramento St.
New York, New York 4: 60 Beaver St.
Pennsylvania, Nesquehoning: 35 E. Center St.

De Zurik Corp., Sartell, Minn.

Diamond Drill Contracting Co., Station B—Box 4065, South 18 Stone St., Spokane 31, Wash.

Diamond Tool Research Co., Inc., 380 Second Ave., New York 10, N. Y.
California, Los Angeles: 220 West 5th St., Western Div.

Diesel Energy Corp., 82 Beaver St., New York, N.Y.

Differential Steel Car Co., Findlay, Ohio

Dodge Manufacturing Corp., Mishawaka, Ind.
California, San Francisco 5: 55 New Montgomery St.
Illinois, Chicago: Room 1705 Old Colony Building, 407 South Dearborn
New York, New York 16: Room 1401, 270 Madison Ave.
Pennsylvania, Pittsburgh 22: Two Gateway Center
Texas, Dallas 7: 2412 Irving Blvd.

Dorr-Oliver Incorporated, 77 Havemeyer Lane, Stamford, Conn.
California, Los Angeles 17: 811 West 7th St.
California, Oakland 1: 2900 Glascock St.
Colorado, Denver: P. O. Box 149 (Englewood)
Georgia, Atlanta: 900 Peachtree St., N. E.
Illinois, Chicago 54: 813 Merchandise Mart
Maryland, Baltimore 18: 2125-27 Maryland Ave.
Minnesota, Virginia: 204 Chestnut Ave.
Ohio, Cleveland 7: 14700 Detroit Ave.
Pennsylvania, Pittsburgh 27: 4209 Clairton Blvd.
Texas, Dallas 25: 6115 Berkshire Lane
Washington, Seattle 99: 420 First Avenue West

The Dow Chemical Co., Midland, Mich.
California, Los Angeles 17: 900 Wilshire Blvd.
California, San Francisco 4: 350 Sansome St.
Georgia, Atlanta 3: 1714 Fulton National Bank Bldg.
Illinois, Chicago 48: 6000 W. Touhy Ave.
Louisiana, New Orleans 12: 1100 Commerce Bldg.
Massachusetts, Boston 16: 520 Boylston St.
Michigan, Detroit 2: 450 Fisher Bldg.
Minnesota, Minneapolis 3: 1750 Hennepin Ave.
Missouri, St. Louis 5: 10 South Brentwood Blvd.
New Jersey, Camden 2: 400 Market St.
New York, Buffalo 2: 70 Niagara St.
New York, New York 20: 45 Rockefeller Plaza
North Carolina, Charlotte 2: 504 Wachovia Bank Bldg.
Ohio, Cincinnati 6: 2330 Victory Parkway
Ohio, Cleveland 13: Terminal Tower
Pennsylvania, Pittsburgh 22: One Gateway Center
Texas, Dallas 1: 1505 Elm St.
Texas, Houston 25: 6910 Fannin St.
Washington, Seattle 1: 1809 Seventh Ave.
Canada, Sarnia, Ontario

Ducon Company, Inc., 147 E. 2nd St., Mineola, L. I., N. Y.
Canada, Burlington, Ontario: 1131 Pettit St.

Eimco Corp., 634 South 4th St. West, Salt Lake City 10, Utah
Alabama, Birmingham 9: Montgomery Highway, Vestavia Hills
California, Berkeley 1: 637 Cedar St., P. O. Box 240
California, San Mateo: 420 Peninsular Ave.
Illinois, Palatine: 301 S. Hicks Rd.
Minnesota, Duluth 12: 1823 E. Superior St.
New York, New York 5: 51-52 South Street
Ohio, Cleveland: 334 Union Bldg., 1836 Euclid Ave.
Pennsylvania, Pittsburgh 5: P. O. Box 666-A, R. D. 5
Texas, El Paso: 1225 Mills Bldg.
Texas, Houston 6: 3215 W. Alabama St.

Electric Storage Battery Co., Exide Industrial Div., Rising Sun & Adams Ave., Philadelphia 20, Pa.

Elektrokemisk A. S., 101 Park Ave., New York, N. Y.

Ellicott Machine Corp., 1611 Bush St., Baltimore 30, Md.
California, San Francisco 5: Room 507 Underwood Building, 525 Market St.

Ensign-Bickford Co., 1660 Hopmeadow St. Simsbury, Conn.

Equipment Engineers, Inc., 737 Loma Verde Ave., Palo Alto, Calif.

Euclid, Div. of General Motors Corp., 1361 Chardon Rd., Cleveland 17, Ohio
California, Oakland 12: Room 660, El Dorado Bldg., 360 22nd St.
Georgia, Atlanta 5: Suite 3-H Luckie Bldg., 361 E. Paces Ferry Road, N. E.
Missouri, Kansas City: 702 V F W Bldg., 406 West 34th St.

Exolon Co., Tonawanda, N. Y.
Illinois, Chicago 40: 5252 North Broadway
Massachusetts, Wellesley Hills 82: 47 River St.
Pennsylvania, Wayne: 663 General Scott Rd.

Fairbanks, Morse & Co., 600 S. Michigan Ave., Chicago 5, Ill.
California, Los Angeles 58: 4535 South Soto St.
California, San Francisco 7: 630 Third St.
Colorado, Denver 16: 4995 Colorado Blvd.
Florida, Jacksonville 5: 533 Stevens St., P. O. Box 6574
Georgia, Atlanta 10: 760 Lee St., S. W.
Illinois, Chicago 5: 1550 S. State St.
Indiana, Indianapolis 7: 1499 N. Harding St.
Kentucky, Louisville 8: 2008 South Brook St.
Louisiana, New Orleans: 1000 St. Charles Ave.
Massachusetts, Boston 10: 178 Atlantic Ave.
Michigan, Detroit 13: 8655 East Eight Mile Rd.
Minnesota, Minneapolis 15: 1121 Flour Exchange Bldg.
Minnesota, St. Paul 1: 220 E. Fifth St.
Missouri, Kansas City 2: 1300 Liberty St.
Missouri, St. Louis 2: 217 S. Eighth St.
Nebraska, Omaha 2: 902 Harney St.
New Jersey, Fair Lawn: 19-01 Harney St.
New York, Buffalo 3: 33-37 Franklin St.
North Carolina, Charlotte 2: 533 Stevens St., P. O. Box 6574
Ohio, Cincinnati 37: 4815 Para Dr.
Ohio, Cleveland 11: 3000 W. 117th St.
Oklahoma, Tulsa 3: 1225 Hunt Bldg.
Oregon, Portland 14: 105 S. E. Taylor St.
Pennsylvania, Philadelphia 8: 401 N. Broad St.
Pennsylvania, Pittsburgh 24: 4301 Main St.
Tennessee, Knoxville 16: 2202 West Cumberland Ave.
Tennessee, Memphis 5: 676 Jefferson Ave.
Texas, Dallas 2: 1713 N. Market St.
Utah, Salt Lake City 1: 153 W. Second South St.
Washington, Seattle 4: 668 Lane St.

Falk Corp., Box 492, Milwaukee 1, Wis.
Alabama, Birmingham 3: Rm. 649, Brown-Marx Bldg.
California, Los Angeles 22: P. O. Box 22049
California, San Francisco 7: 427 Bryant St.
Colorado, Denver 3: 655 Broadway Bldg.
Illinois, Chicago 3: 105 W. Adams St.
Illinois, Peoria: 800 S. W. Adams St.
Minnesota, Minneapolis 4: 807 Thirteenth Ave. South
Missouri, St. Louis 5: 8029 Forsyth Blvd.
New York, New York 17: 200 East 42nd St., Room 2800
Ohio, Cleveland 15: 2036 E. 22nd St., Rm. 215
Pennsylvania, Pittsburgh 34: 300 Mt. Lebanon Blvd., Suite 200B
West Virginia, Charleston 2: P. O. Box 10066
Wisconsin, Milwaukee 1: Box 492

Farris Flexible Valve Corp., Palisades Park, N. J.

Fate-Root-Heath (See Plymouth Locomotive)

Firestone Tire & Rubber Co., 12 S. Main St., Akron 12, Ohio

Flexible Steel Lacing Co., 4607 Lexington St., Chicago 44, Ill.
California, San Mateo: 10 Jody Court
Connecticut, Fairfield: 139 Short Hill Lane
Georgia, Atlanta 19: 1224 Spring Mill Court
Illinois, Wheaton: RFD 2, Box 25, Orchard Rd.
Indiana, Indianapolis 20: 1006 Chevy Chase Lane
Minnesota, Wayzata: Route 1, Box 54
Missouri, Kansas City 13: 630 Huntington Rd.
North Carolina, Raleigh: 2518 Clark Ave.

Ohio, Vermilion: Portage Dr., Vermilion Lagoons
Pennsylvania, Springfield, Dela. Co., 490 Kerr Lane
Texas, Dallas 8: 1330 Hollywood Ave.
Washington, Seattle 77: 2403 W. 197th St.
Canada, Ontario, Toronto 12: 54 Mason Blvd.

Ford Div., Ford Motor Co., Rotunda Dr. at Southfield Rd., Dearborn, Mich.
California, Los Angeles 22: 4940 E. Sheila St., P. O. Box 6787
California, San Jose: P. O. Box 1181
Colorado, Denver 17: 2650 East 40th Ave., P. O. Box 5588—Terminal Annex
District of Columbia, Washington 1: 261 Constitution Ave., N. W.
Florida, Jacksonville 3: Foot of Wamboldt St., P. O. Box Y
Georgia, East Point: 1122 Milledge Drive, P. O. Box 107
Illinois, Melrose Park: 2225 North Ave.
Illinois, Rockford: 610 East State St., P. O. Box 379
Indiana, Indianapolis 4: 1800 North Meridian
Iowa, Davenport: Insurance Exchange Bldg., 220 East 2nd St.
Iowa, Des Moines 3: 2121 E. Walnut St., P. O. Box 617
Kentucky, Louisville 1: Fern Valley Rd. at Grade Lane, P. O. Box 1435
Louisiana, Arabi 16: 7200 North Peters St., P. O. Box 118
Massachusetts, Natick: Worcester Turnpike at Speen Rd., P. O. Box 209
Michigan, Dearborn: The American Rd.
Michigan, Lansing: 220 West Washtenaw St., P. O. Box 1297
Michigan, Livonia: 29500 Plymouth Rd., P. O. Box 2186
Minnesota, Minneapolis 18: 63 St. Anthony Blvd. N. E.
Missouri, Clayton: 111 Bemiston St., P. O. Box 44
Missouri, Kansas City 41: P. O. Box 738
Nebraska, Omaha 14: 7117 Farnam St., P. O. Box 1498—Peony Park Station
New Jersey, Teterboro: U. S. Highway 46
New York, Buffalo: 1010 Rand Bldg., 14 Lafayette Square, P. O. Box 3015
North Carolina, Charlotte 1: Wilkinson Blvd. at Dixie Rd., P. O. Box 780
North Dakota, Fargo 2: 1101 1st Avenue North
Oklahoma, Oklahoma City 2: 900 West Main St.
Ohio, Cincinnati 15: Jimson & Lockland Rds., P. O. Box 4, Lockland Branch
Ohio, Cleveland 1: 5800 Grant Avenue, P. O. Box 6539
Pennsylvania, Drexel Hill: 5100 State Rd.
Pennsylvania, Pittsburgh 30: 2001 Lebanon Rd., P. O. Box 1078
Tennessee, Memphis 1: 2970 Jackson Ave., P. O. Box 6767, Hollywood Sta., Memphis 8, Tenn.
Texas, Dallas 2: 521 North Industrial Blvd., P. O. Box 5414
Texas, Houston 1: 5800 Clinton Drive, P. O. Box 1851
Utah, Salt Lake City 10: 414 West 3rd South St., P. O. Box 2130
Virginia, Richmond 11: Lewis & Ferncroft Rds., P. O. Box 1380
Washington, Seattle 24: 4141 Fourth Ave. S., P. O. Box 3565

Gardner-Denver Corp., Quincy, Ill.
California, Los Angeles 22: 7654 E. Slauson Ave.
California, San Francisco 7: 811 Folsom St.
Colorado, Denver 1: 1727 E. 39th Ave., P. O. Box 1020
Idaho, Wallace: 407 Seventh St., P. O. Box 788
Louisiana, New Orleans 25: 7735 Edinburgh St., P. O. Box 13155
Minnesota, Duluth 2: 521 East Superior
Missouri, Kansas City 14: 309 W. 79 Terrace
Montana, Butte: 215 E. Park St.
New York, Buffalo 26: 4532 Bailey Ave.
New York, New York 7: 233 Broadway, Woolworth Bldg.
Ohio, Cleveland 11: 3088 W. 117th St.
Pennsylvania, Hazelton: P. O. Box 17
Pennsylvania, Philadelphia 40: 4309-11 Rising Sun Ave.
Pennsylvania, Pittsburgh 26: 520 McNeilly Rd.
Texas, El Paso: 1704 Paisano Drive
Texas, Dallas 35: 7125 Harry Hines Blvd., P. O. Box 35106
Utah, Salt Lake City: 113 W. Second South St.
Washington, Seattle 4: 615 Eighth Ave. South
Australia, Artarmon, N. S. W.: 70 Hotham Parade
Canada, Edmonton, Alberta: 14415-114
Canada, Moncton, New Brunswick: E. Main St., P. O. Box 475
Canada, Montreal 28, Quebec: 5825 St. James St., W.
Canada, Nelson, B. C.: 745 Baker St.
Canada, Toronto 16, Ontario: 14 Curity Ave.
Canada, Vancouver 9, B. C.: 1775 Pine
Canada, Winnipeg 3, Manitoba: 1400 Sargent Ave.
Northern Rhodesia, Ndola: P. O. Box 18, Alacrity House, Cr. Third St. & Monterey Ave.
Mexico, Mexico City 6, D. F.: Apartado 575
South America, Lima, Peru: Apartado 674
South America, Rio de Janeiro, Brazil: Avenida Churchill 94-B, Caixa Postal 4293
Union of S. Africa: Johannesburg Transvaal: P. O. Box 4807

Gates Rubber Co., Sales Div., Inc., 999 South Broadway, Denver 17, Colo.
Alabama, Birmingham 4: 3016 Eighth Ave., North, P. O. Box 1210
Arizona, Phoenix: 2533 West Cypress
Arkansas, Little Rock: 411 Center St.
California, Los Angeles 58: 2850 E. 46th St.
California, South San Francisco: 242 Shaw Rd.
Colorado, Denver 17: 999 So. Broadway
Florida, Tampa: P. O. Box 393
Georgia, Decatur: 3031 E. Ponce de Leon Ave., P. O. Box 889
Illinois, Chicago 32: 3035 West 47th St.
Illinois, Mt. Vernon: 12 North Highland Place
Michigan, Detroit 27: 15844 Schaefer Highway
Minnesota, Minneapolis 3: 638-44 Second Ave., North
Missouri, Joplin: 303 Joplin St.
Missouri, North Kansas City 16: 110 East 9th Ave.
Missouri, St. Louis 9: 3150 Brannon Ave.
Montana, Billings: 404 South 28th St., P. O. Box 2561
New York, Buffalo 3: 79 Swan St.
New York, New York 3: 215-219 Fourth Ave.
Ohio, Cincinnati 29: 814 Melbourne Ave.
Ohio, Cleveland 35: 15400 Industrial Parkway Dr.
Oregon, Portland 10: 2551 N. W. 30th Ave., P. O. Box 9577, Wardway Station
Pennsylvania, Philadelphia 6: 1306 Mall Bldg., 4th & Chestnut Sts.
Pennsylvania, Pittsburgh 22: 26th and Penn Avenue
Tennessee, Knoxville: 317 Gay Street, N. W.
Utah, Salt Lake City: 748 Genessee Ave., P. O. Box 2097
Washington, Spokane 11: 9 Cataldo St.
West Virginia, Huntington 1: 519 Sixth St.
Wisconsin, Green Bay: 414 E. Walnut, 106 Columbus Bldg.
Wisconsin, Milwaukee 8: 831 N. 27th St.

General American Transportation Corp., 135 South La Salle St., Chicago 90, Ill.
Alabama, Birmingham: P. O. Box 1870
California, Los Angeles 17: 900 Wilshire Blvd.
California, San Francisco 4: 235 Montgomery St.
Kentucky, Louisville 2: 139 South Fourth St.
Louisiana, New Orleans 12: 210 Baronne St.
Missouri, St. Louis 1: 915 Olive St.
New Jersey, Clifton: Parker-Kalon Div.
New York, Buffalo 3: 2008 Rand Bldg.
New York, New York 17: 380 Madison Ave.
Ohio, Cleveland 13: 1307 Terminal Tower Bldg.
Oklahoma, Tulsa: 1005 First National Bank Bldg.
Pennsylvania, Pittsburgh 19: 2612 Koppers Bldg.
Texas, Dallas 2: First National Bank Bldg.
Texas, Houston 2: 919 Bank of the Southwest Bldg.
Utah, Salt Lake City: (Orem Plant) P. O. Box 97, Orem, Utah
Washington, Seattle 1: Joseph Vance Bldg., Third and Union Sts.

General Tire & Rubber Co., 1708 Englewood Ave., Akron, Ohio

General Chemical Div., Allied Chemical & Dye Corp., (Baker & Adamson Products) 61 Broadway, New York 6, N. Y.
Illinois, Chicago 54, Merchandise Mart (Room 430)
Louisiana, New Orleans 12: 1107 Pere Marquette Bldg.
Michigan, Detroit 17: 7501 W. Jefferson Ave.
Missouri, St. Louis 8: 3615 Olive St.
New York, New York 16: 261 Madison Ave.
New York, Syracuse 9: Milton Ave.
North Carolina, Charlotte: 503 N. College St.
Ohio, Cincinnati 2: 3616 Carew Tower
Ohio, Cleveland 15: 3121 Euclid Ave.
Pennsylvania, Philadelphia 7: 12 S. 12th St.
Pennsylvania, Pittsburgh 22: 1 Gateway Center
Texas, Houston 2: 1121 Walker Ave.

Geodimeter Co., Div. of Berg, Hedstrom & Co., Inc., 1170 Broadway, New York, N. Y.

GM Diesel, Detroit Diesel Engine Div., General Motors Corp., 13400 W. Outer Dr., Detroit 28, Mich.
California, San Francisco 4: 1426 Russ Bldg., 235 Montgomery St.
Georgia, Atlanta 5: Suite 2-A, 359 East Paces Ferry Rd., N. E.
Illinois, Chicago 6: 110 N. Wacker Dr.
Michigan, Wayne: 36501 Van Born Rd.
New York, New York 19: 1320 Coliseum Office Bldg., 10 Columbus Circle
Texas, Dallas 2: 1717 Adolphus Tower, 1412 Main St.

Godoy & Co., Inc., E. A., 25 Broadway, New York 4, N. Y.

Goodrich Tire Co., B. F., A Div. of B. F. Goodrich Co., Akron 18, Ohio

B. F. Goodrich Industrial Products Co., Div. of B. F. Goodrich Co., 500 South Main St., Akron 18, Ohio
California, Los Angeles 22: 3525 S. Garfield Ave.
California, San Francisco 24: 1950 Army St.
Colorado, Denver 4: 2500 W. Eighth Ave.
Georgia, Atlanta 6: 1721 DeKalb Ave. N. E.
Illinois, Chicago 44: 4646 West Lake St.
Kansas, Kansas City 15: 830 Kindelberger Rd.
Michigan, Allen Park: 16500 Oakwood Blvd.
Minnesota, Minneapolis 16: 800 Turners Crossrd.
New York, New York 17: 230 Park Ave.
Ohio, Columbus 14: 3770 Indianola Ave., P. O. 3507
Pennsylvania, Philadelphia 34: 955 E. Erie Ave.
Texas, Dallas 2: 1400 Turtle Creek Blvd., P. O. 6185

Goodyear Tire & Rubber Co., Metal Products Division, Akron, Ohio

Gordon I. Gould & Co., 58 Sutter St., San Francisco 4, Calif.

Gould-National Batteries, Inc., Trenton 7, N. J.
California, La Puente: 14,500 Nelson
California, Oakland: 949 55th St.
Colorado, Denver: 4150 Fox St.
Georgia, Atlanta: Farrar Bldg., 10 N. Clarendon Rd., Avondale Estates
Illinois, Chicago: 100 E. Ohio St.
Michigan, Detroit: 3105 E. Grand Blvd.
Missouri, Kansas City: 7941 State Line Rd.
New York, New York: 7 Dey St.
Oregon, Portland: 1973 N. W. Lovejoy St.
Pennsylvania, Philadelphia: 1014 Beury Bldg.
Pennsylvania, Pittsburgh: 1597 Banksville Rd.
Texas, Dallas: 137 Walnut Hills Village
Utah, Salt Lake City: 415 South 2nd East
West Virginia, Huntington: 1111 Vernon St.

Grinnell Co., Inc., 260 West Exchange St., Providence 1, R. I.
California, Fresno 1: 3081 Hamilton Ave.
California, San Francisco 7: 601 Brannan St.
Colorado, Denver 2: 2175 Fifteenth St.
Illinois, Chicago 9: 4425 South Western Ave.
Minnesota, Minneapolis 15: 623 Washington Ave., South
Montana, Billings: 13 North Twenty-Third St.
Montana, Great Falls: 12 Third St., Northwest
New York, New York 22: 400 Park Ave.
North Carolina, Charlotte 8: 1431 West Morehead St.
Ohio, Cleveland 3: 1294 East 55th St.
Pennsylvania, Pittsburgh 33: 1020 Ridge Ave.
Washington, Spokane 3: East 909 Sprague Ave.
Canada, Edmonton, Alta.: 11340—120th St.
Canada, Montreal 16, Que.: 3980 Namur St.
Canada, Toronto 9, Ont.: 2440 Dundas St., West
Canada, Vancouver 6, B. C.: 1150 Raymur Ave.

Hamilton Rubber Mfg. Corp., Meade St., Trenton 3, N. J.
California, Los Angeles: 5024 Hampton St.
Georgia, Atlanta: 649 Ponders Ave., N. W., P. O. Box 2661, Station D
Illinois, Chicago: 1238 W. Washington Blvd.
New York, New York 19: 200 West 57th St.
Texas, Houston: 2017 Preston Ave., P. O. Box 2010.

Harbison-Walker Refractories Co., 307 Fifth Ave., Pittsburgh 22, Pa.
California, San Francisco 5: 625 Market
Colorado, Canon City
Illinois, Chicago 3: 30 West Monroe St.
Massachusetts, Boston 10: 10 High St.
Michigan, Detroit 35: 17601 James Couzens Highway
Missouri, St. Louis 1: 1325 Ambassador Bldg.
New York, New York 5: 68 William St.
Pennsylvania, Philadelphia 3: 981 Suburban Station Bldg.
Pennsylvania, Pittsburgh 22: 307 Fifth
Texas, Houston 25: 1319 Prudential Bldg.
Canada, Ontario, Hamilton: 105 Walnut St., South
Canada, Quebec, Montreal 2: Room 540, Canada Cement Bldg.

Hardinge Co., 240 Arch Street, York, Pa.
California, San Francisco 11: Room 720, 24 California St.
Illinois, Chicago 6: 1907 Engineering Bldg., 205 W. Wacker Dr.
Minnesota, Hibbing: P. O. Box 368
New York, New York 17: 3906 Channin Building, 122 E. 42nd St.
Utah, Salt Lake City 15: 333 W. 14th South St.
Canada, Ontario, Toronto 1: 44 Victoria St.

Harnischfeger Corp., 4400 W. National Ave., Milwaukee 46, Wis.
Alabama, Birmingham 4: 1629 Vanderbilt Road, Box 1150
Arizona, Phoenix: Room 252, 3300 N. Central Ave.
California, Los Angeles 59: 2400 East Imperial Highway
California, San Francisco: 212 Shell Building, 100 Bush St.
Colorado, Denver: Room 810, Central Bank Bldg., 1108 15th St.
Florida, Miami 56: 12035 South Dixie Highway
Georgia, Atlanta: Luckie Bldg., 361 E. Paces Ferry Rd.
Illinois, Chicago 6: North Wacker Dr.
Michigan, Detroit 35: 17618 West McNichols Rd.
Minnesota, Minneapolis 8: 2614 Nicollet Ave.
Missouri, Kansas City 5: Rooms 604-5, 1012 Baltimore Building
Missouri, St. Louis (in Clayton 5): Room 202, Brown Building, 101 South Meramec Ave.
New York, Buffalo 22: Room 106, 257 Elmwood Ave.
New York, New York 7: Room 730, Hudson Terminal Bldg., 30 Church St.
Ohio, Cincinnati 37: Roselawn Center Building, Reading & Section Roads
Ohio, Cleveland 14: Rooms 1201-2 Superior Bldg., 815 Superior Ave., N. E.
Ohio, Dayton: 53 Park Ave.
Pennsylvania, Philadelphia 3: 944 Suburban Office Building
Pennsylvania, Pittsburgh 22: 1428 Banksville Rd.
Texas, Dallas 7: 1225 North Industrial Blvd.

Mancha Storage Battery Locomotive
Louisiana, Shreveport: 2737 Linwood
Nachod & United States Signal Co.,
District of Columbia, Washington 4:

Washington, Seattle 4: 2909 First Ave., South
Wisconsin, Milwaukee 46: 4400 West National Ave.

Hendrick Manufacturing Co., Carbondale, Pa.
Pennsylvania, Hazelton: 531 N. Locust St.
Pennsylvania, Pittsburgh: 6802 Frankstown Ave.

Harbison-Walker Refractories Co., 307 Fifth Ave., Pittsburgh 22, Pa.
California, San Francisco 5: 625 Market
Massachusetts, Boston 10: 10 High St.
Michigan, Detroit 35: 17601 James Couzens Highway
Missouri, St. Louis 1: 1325 Ambassador Bldg.
New York, New York 5: 68 William St.
Pennsylvania, Philadelphia 3: 981 Suburban Station Bldg.
Pennsylvania, Pittsburgh 22: 307 Fifth
Texas, Houston 25: 1319 Prudential Bldg.
Canada, Ontario, Hamilton: 105 Walnut St., South
Canada, Quebec, Montreal 2: Room 540, Canada Cement Bldg.

Hercules Motors Corp., 101 11th St., Canton, Ohio

Hercules Powder Co., 900 Market St., Wilmington 99, Del.
Alabama, Birmingham 3: First National Building, 17 N. 20th St.
California, Los Angeles 5: 3460 Wilshire Blvd.
California, San Francisco 4: 120 Montgomery St.
Illinois, Chicago 4: McCormick Bldg., 332 S. Michigan Ave.
Minnesota, Duluth 2: Torrey Bldg., 314-16 W. Superior St.
Missouri, Joplin: First National Bank Bldg., 404 Main St.
New York, New York 17: 380 Madison
Pennsylvania, Pittsburgh 22: 2 Gateway Circle, 603 Stanwix St.
Utah, Salt Lake City 1: Kearns Bldg., 136 S. Main St.

Hewitt-Robins, Inc., 666 Glenbrook Rd., Stamford, Conn.
Alabama, Birmingham: 3118 3rd Ave. South
Arizona, Phoenix: 207-B Camelback Rd.
California, Los Angeles: 2604 S. Malt Ave.
California, San Francisco 5: 55 New Montgomery St.
Colorado, Denver: 660 Bennock St.
Colorado, Denver: 5075 Colorado Blvd.
Florida, Miami Beach: 961 W. 48th St.
Illinois, Chicago 6: 402 W. Randolph St.
Illinois, Chicago 24: 4401 W. Roosevelt Rd.
Indiana, Indianapolis 22: 2813 Questend S. Dr.
Kentucky, Louisville 7: 319 Foeburn Lane
Louisiana, New Orleans 14: 109 Cambridge St., Aurora Gardens
Louisiana, Shreveport: 831 Gladstone St.
Michigan, Ferndale 20: 1840 Hilton Rd.
Minnesota, Hibbing: 718 E. Howard St.
Minnesota, Minneapolis 1: 533 Metropolitan Bldg.
Missouri, Kansas City 11: 312 VFW Bldg., 406 W. 34th St.
Missouri, St. Louis 10: 4030 Chouteau Ave.
New York, New York: 370 Lexington Ave.
North Carolina, Charlotte 6: P.O. Box 5277
Ohio, Cleveland 14: 314 Superior Ave., NE
Oklahoma, Tulsa: 310 Thompson Bldg.
Oregon, Portland 14: 714 N.E. 1st Ave.
Pennsylvania, Ft. Washington: Ft. Washington Park
Pennsylvania, Pittsburgh 19: 951-952 Union Trust Bldg.
Tennessee, Memphis 17: 5111 Sea Isle
Texas, Houston 11: 2528 Oakland Ave.
Texas, Houston 11: 5711 Navigation St.
Virginia, Richmond 5: 2910 W. Clay St.
Washington, Seattle: 641 Dexter Horton Bldg.
West Virginia, Bluefield: 1417 College Ave.
West Virginia, Charleston 4: P.O. Box 4207
West Virginia, Fairmont: Upper Circle, Peacock Park

The Frank G. Hough Co., 726 Sunnyside Ave., Libertyville, Ill.

Huber-Warco Co., Marion, Ohio

Industrial Physics & Electronics Co., 470 S. 10th E. St., Salt Lake City, Utah

Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Alabama, Birmingham 3: 1700 Third Ave., South
California, Los Angeles: 5533 Olympic Blvd.
California, San Francisco 7: 350 Brannan St.
Colorado, Denver 2: 1641 Blake St.
Illinois, Chicago: 400 W. Madison St.
Louisiana, New Orleans 25: 960 Genois St.
Michigan, Detroit 26: Congress at First
Minnesota, Duluth 2: 327 W. Michigan
Montana, Butte: 845 S. Montana St.
New York, New York 4: 11 Broadway
New York, Buffalo 2: 117 W. Chippewa St.
Ohio, Cleveland 3: 4506 Chester Ave.
Oklahoma, Picher: 226 West A. St.
Oregon, Portland 5: Room 1004 Broadway Bldg.
Pennsylvania, Pittsburgh 22: 932 Penn
Tennessee, Knoxville 24: 412 W. Jackson Ave.
Texas, Dallas: 1728 Canton St.
Texas, El Paso: 2100 Wyoming St.
Utah, Salt Lake City 1: 144 S. W. Temple St.
Virginia, Richmond 21: 3431 W. Leigh St.
Washington, Seattle 4: 527 First Ave., South

International Bartering Corp., 52 Broadway, New York 4, N.Y.
D.C., Washington: 14th & G Sts., N.W., Colorado Bldg.

International Harvester Co., 180 North Michigan Ave., Chicago 1, Ill.
Alabama, Birmingham 2: 931 North 24th St., P. O. Box 2573
Arkansas, Little Rock: 812 East Second St.
Colorado, Denver 17: 4233 East 46th Ave., P. O. Box 5028
Florida, Jacksonville 1: 1986 West Beaver St., P. O. Box 869
Georgia, Atlanta 2: 580 Whitehall St., S. W. P. O. Box 4297
Kentucky, Louisville: 1326 West Walnut St.
Minnesota, Minneapolis: 2572 University Ave., St. Paul 14, Minnesota
Minnesota, St. Cloud: 539 East St. Germain St.
Minnesota, St. Paul 14: 2572 University Ave.
Missouri, St. Louis: Highway 66 & Brown Rd., Robertson, Mo.
Montana, Billings: 20 South Broadway
Oklahoma, Oklahoma City 1: 512 South Broadway, P. O. Box 1337
Tennessee, Memphis 2: 237 West Olive Ave., P. O. Box 2864
Tennessee, Nashville 3: 1113 McGavock St.
Texas, Amarillo: 714 East 10th St.
Texas, Dallas 15: 1809 South Lamar St.
Texas, Houston 1: 4619 Navigation Blvd., P. O. Box 1425
Texas, San Antonio 6: 1344 South Flores St.
Utah, Salt Lake City 10: 435 West Fourth South St., P. O. Box 660
Washington, Spokane 3: 715 East Sprague Ave.

International Minerals & Metals Corp., 11 Broadway, New York 4, N.Y.

International Nickel Co., 67 Wall Street, New York 5, N. Y.

Iowa Manufacturing Co., 916 16th St., N.E., Cedar Rapids, Iowa

The Jeffrey Manufacturing Co., 974 N. Fourth St., Columbus 16, Ohio
Alabama, Birmingham 5: 3012 Fourth Ave. South
California, Burlingame: 1862 Rollins Rd.
Colorado, Denver 2: E C Horne Mach'ry Co., 1726 Champa St.
Illinois, Chicago 1: 307 North Michigan Ave., Old Republic Bldg.
Missouri, St. Louis 5: 219 Slavin Bldg., 8000 Bonhomme Ave.
New York, New York 7: 30 Church St.
Pennsylvania, Pittsburgh 22: 1424 Oliver Bldg.
Utah, Salt Lake City 16: 15-N West Temple St.
Wisconsin, Milwaukee 2: 735 N. Water St.

Jenkins Bros., 100 Park Ave., New York 17, N. Y.
California, San Francisco 4: 1410 Russ St.
Georgia, Atlanta 3: 1603 Fulton National Bank Bldg.
Illinois, Chicago 4: 1520 Board of Trade Bldg.
Massachusetts, Boston 10: 75 Federal St.
Pennsylvania, Philadelphia 4: 1624

Jones & Laughlin Steel Corp., 3 Gateway Center, Pittsburgh 30, Pa.

Joy Mfg. Co., Henry W. Oliver Bldg., Pittsburgh 22, Pa.
Alabama, Birmingham: 601 North 10th St., P. O. Box 1712
California, San Francisco 3: 1155 Harrison St.
Colorado, Denver 2: 1626 Wazee St.
Minnesota, Duluth 2: 1021 E. Superior St.
Missouri, St. Louis 10: 1203 Macklind Ave.
Montana, Butte: 24 West Granite St.
New York, New York 6: 140 Cedar St.
Oregon, Portland 9: 1631 N. W. Thurman St
Pennsylvania, Pittsburgh 16: 3021 Banksville Rd.
Tennessee, Knoxville 2: 108 West Main Ave.
Texas, El Paso: 1022 Wyoming St., P. O. Box 56
Utah, Salt Lake City 10: 998 South 6th West St., P. O. Box 2586
Washington, Seattle 4: 2411 Western Ave.
Washington, Spokane: North 4015 Belt

Kaiser Engineers, 1924 Broadway, Oakland 12, Calif.
New York, New York 22: 300 Park Ave.
Pennsylvania, Pittsburgh 19: Rm. 3301 Grant Bldg., 330 Grant St.

KW-Dart Truck Co., 1301 North Manchester Trafficway, Kansas City, Mo.
New York, Long Beach: 23 Virginia Ave.
Ohio, Cleveland: West Lake Hotel
Ohio, North Ridgeville: 34554 Lorain Rd.

Kellogg Co., M. W., 711 Third Ave., New York 17, N.Y.

Kennedy Van Saun Mfg. & Eng. Corp., 405 Park Ave., New York 22, N. Y.
Pennsylvania, Danville

Lawrence Pumps Inc., 371 Market St., Lawrence, Mass.

Le Roi Div., Westinghouse Air Brake Co., Milwaukee 1, Wis.
California, Oakland 12: Rm. 802 Easton Bldg., 428-13th St.
Colorado, Denver 3: 610 Farmers Union Bldg.
Georgia, Atlanta 3: 1621 Candler Bldg.
New York, New York 20: 45 Rockefeller Plaza
Ohio, Cleveland 9: 4798 W. 35th St.
Oklahoma, Tulsa 19: Suite 307-A IBM Bldg., 1307 South Boulder
Ontario, Downsview: 465 Wilson Ave., West.

Letourneau-Westinghouse, P. O. Box 240, Peoria, Ill.

Lectromelt Furnace Div., McGraw-Edison Co., P. O. Box 1257, Pittsburgh 30, Pa.

Linatex Corp. of America, Stafford Springs, Conn.
Canada, Quebec, Montreal 9: 1975 Bois Franc Rd., Wilkinson Linatex Co.

Link-Belt Co., Dept. EMBGL-59, Prudential Plaza, Chicago 1, Ill.

Logan Engineering Co., 4901 West Lawrence Ave., Chicago 30, Ill.

Lubriplate Div., Fiske Bros. Refining Co., 125 Lockwood St., Newark 5, N. J.
Ohio, Toledo 5

Lukens Steel Co., Coatesville, Pa.
Colorado, Denver 4: Room 104, Goby Bldg., 1321 Bannock St.
Illinois, Chicago 4: Room 1042, McCormick Bldg., 332 South Michigan Ave.
Ohio, Cincinnati 37: P. O. Box 2633, 1720 Section Rd.
Ohio, Cleveland 14: 1201 Citizens Bldg.
Pennsylvania, Pittsburgh 19: 2005 Law & Finance Bldg., 429 Fourth Ave.
Virginia, Richmond: 717-718 Central National Bank Bldg.

Mace Co., 2763 Blake St., Denver 5, Colo.

Machinery Center, Inc., 1201 S. 6th West St., P. O. Box 964, Salt Lake City 1, Utah
Washington, Chelan: P. O. Box 762
Canada, Winnipeg, Manitoba: 416 Ave. Bldg.

Mack Trucks, 1355 West Front Street, Plainfield, N. J.
Alabama, Birmingham: 2820 Sixth Ave., So. (P. O. Box 1009)
California Arcata: 50 South "G" St. (P. O. Box 457)
California, Los Angeles: 2001 S. Alameda St.
California, Palo Alto: 499 Hamilton Ave.
California, San Francisco: 1745 Folsom St.
Colorado, Denver: 4850 Vasquez Blvd.
Florida, Jacksonville: 2203 West Beaver St. (P. O. Box 2880)
Florida, Tampa: 604 So. Morgan St. (P. O. Box 1404)
Georgia, Atlanta: 780 Memorial Drive, S. E.
Illinois, Chicago: 33rd St. & Wentworth Ave.
Indiana, Indianapolis: 1810 W. 16th St.
Kentucky, Louisville: 225 East Walnut St.
Louisiana, New Orleans: 1001 So. Jefferson Davis Pkway.
Michigan, Detroit 10401 Ford Rd., Dearborn
Minnesota, St. Paul: 2505 University Ave. (Midway)
Missouri, Kansas City: 3738 Gardner Ave.
Missouri, St. Louis: 2350 Chouteau Ave.
New Jersey, Newark: 1239 Broad Street
New York, Albany: 1064 Broadway
New York, Buffalo: 267 Michigan Ave.
New York, Newburgh: P. O. Box 791, MD 15, Route 17K
New York, Poughkeepsie: 205 Delafield St. (P. O. Box 471)
New York, Syracuse: East Erie Blvd.
North Carolina, Charlotte: 228 Dalton Ave. (P. O. Box 1967)
Ohio, Akron: 1100 Triplett Blvd. (P. O. Box 7155)
Ohio, Cincinnati: 1223 W. 8th St.
Ohio, Cleveland: 13600 Broadway
Oklahoma, Oklahoma City: 1816 N. E. 10th St.
Oregon, Eugene: 933 Franklin Blvd. (P. O. Box 1108)
Oregon, Portland: 1122 N. Williams Ave.
Pennsylvania, Erie: 960 West 12th St.
Pennsylvania, Harrisburg: 2020 Paxton St.
Pennsylvania, Philadelphia: 2647 East York St.
Pennsylvania, Pittsburgh: 728 Shore Ave.
Texas, Dallas: 901 So. Akard St. (P. O. Box 1528)
Texas, Fort Worth: 2812 North Main St. (P. O. Box 4501)
Texas, Houston: 5331 Gulf Freeway (P. O. Box 18515)
Utah, Salt Lake City: 704 South Third West St.
Virginia, Richmond: 1705 Ninth Street Road
Washington, Seattle: 3707 Airport Way
West Virginia, Charleston: 5800 McCorkle Ave., S. E.
Canada, Montreal: 2150 Cote de Liesse Road
Canada, Regina, Sask.: 1333 McIntyre St.
Canada, Toronto, Ont.: 45 Strachan Ave.
Canada, Winnipeg, Manitoba: 301 Princess St.

Magor Car Corp., 50 Church St., New York 7, N. Y.
California, San Francisco 11: 1045 Sansome St.

Mancha Storage Battery Locomotive Div., Goodman Mfg. Co., Halsted St. & 48th Pl., Chicago 9, Ill.
Canada, North Bay, Ontario: Mancha Locomotive, Div. of Goodman Manufacturing Co. of Canada, Ltd.

Manitowoc Engineering Corp., South 16th St., Manitowoc, Wisc.

Marion Power Shovel Co., A Div. of Universal Marion Corp., 617 W. Center St., Marion, Ohio
Arizona, Phoenix: 1017 N. 22nd Ave.
California, S. San Francisco: 326 Shaw Rd.
Florida, Ft. Lauderdale: 3300 Southwest 22nd St.
Illinois, Chicago 4: Room 1404, McCormick Bldg., 332 S. Michigan Ave.
Indiana, Indianapolis 26: 5202 E. Dickson Rd.
Louisiana, New Orleans 14: 2500 Bristol Place
Massachusetts, Wellesley Hills 82: 89 Wellesley Ave.
Minnesota, Excelsior: Route 3
Missouri, Kansas City: Room 309, 1016 Baltimore Ave.
Missouri, St. Louis 8: 4378 Lindell Blvd.
New York, New York 17: 420 Lexington Ave.
Ohio, Columbus 21: 2245 Nottingham Rd.
Oregon, Portland 1: 2651 S. W. Sherwood Place
Pennsylvania, Emmaus: 105 Spruce St.
Pennsylvania, Pittsburgh 34: 609 Kenilworth Dr.
Texas, Dallas: 2505 Crest Ridge Dr.
Virginia, Annandale: 1110 Accotink Dr.

McLanahan & Stone Corp., Hollidaysburg, Pa.

The McNally Pittsburg Mfg. Corp. 307 West Third St., Pittsburg, Kansas
Illinois, Chicago 1: 307 N. Michigan Ave.
Ohio, Wellston: P. O. Box 228.

Merrick Scale Co., 182 Autumn St., Passaic, N. J.

Mine Safety Appliances Co., 201 North Braddock Ave., Pittsburgh 8, Pa.
Alabama, Birmingham 4: 2500 12th Ave., North
Arizona, Tucson: 1906 E. 18th St.
California, San Francisco 3: 1255 Howard St.
Colorado, Denver: 2916 Forest St.
Michigan, Ishpeming: 584 Elliott
Missouri, St. Louis 3: 1915 Washington
Montana, Billings: 4435 Jansma Ave.
Montana, Butte: 2419 Princeton Ave.
Pennsylvania, Pittsburgh 8: 201 N. Braddock Ave.
Utah, Salt Lake City 1: 257 Rio Grande
Washington, Seattle 4: 71 Columbia St.
West Virginia, Bluefield: 1513 Bluefield

Mine & Smelter Co., 3800 Race St., Denver 16, Colo.
New York, New York 17: 122 East 42nd St.
Texas, El Paso: 1515—11th Ave.
Utah, Salt Lake City 1: 121 W. Second South St.

Minneapolis-Honeywell Regulator Co., Wayne and Windrim Aves., Philadelphia 44, Pa.
Alabama, Birmingham 5: 2616 7th Ave., S.
Alabama, Huntsville: P. O. Box 525
Alabama, Mobile: 105 N. Florida St.
Alaska, Anchorage: P. O. Box 1477, 420 Post Rd.
Arizona, Phoenix: 4125 North 7th Ave.
Arkansas, Little Rock: 608 West 3rd St.
California, Fresno: 446 Blackstone Ave.
California, Gardena: Appl. Control Div., 17300 Western Ave.
California, Los Angeles 22: 6620 Telegraph Rd.
California, Sacramento 14: 1402 E. St.
California, San Diego 1: 2153 Moore St.
California, San Francisco 24: 2 Dorman Ave.
California, Santa Clara: 949 Main St.
Colorado, Denver 4: 1600 West 13th Ave.
Florida, Jacksonville 2: 1746 E. Adams St.
Idaho, Idaho Falls: 541 2nd St.
Illinois, Chicago 80: 7350 N. Lincoln Ave., P. O. Box 8530A
Illinois, Harvey: P. O. Box 170
Louisiana, Baton Rouge: 1545 N. Foster Dr.
Louisiana, New Orleans 22: 2369 Prentiss Ave., P. O. Box 8038
Louisiana, Shreveport: 2737 Linwood Ave.
Michigan, Grand Rapids 2: 1549 Buchanan Ave. S. W.
Michigan, Lansing: 521 N. Washington Ave.
Michigan, Saginaw 57: 1830 N. Michigan Ave.
Minnesota, Duluth: 926 E. 2nd St.
Minnesota, Minneapolis 14: 621 E. Hennepin Ave.
Minnesota, Moorhead: 1301 Center Ave.
Missouri, St. Louis 8: 4354 Olive St.
Montana, Billings: Selvidge-Babcock Bldg., 2718 Montana Ave.
New Mexico, Albuquerque: 2502 Garfield Ave. S. E.
New York, Binghamton: 94 Henry St.
New York, Long Island City 1, 24-30 Skillman Ave.
Ohio, Cleveland 14: The Tower Press Bldg. 1900 Superior Ave.
Oregon, Portland 15: 2600 S. E. Belmont
Pennsylvania, Philadelphia 44: Brown Instruments Div., Wayne & Windrim Aves.
Pennsylvania, Pittsburgh 27: 4120 Brownsville Rd.
South Dakota, Sioux Falls: 213 N. Nesmith Ave.
Tennessee, Chattanooga 11: 3223 Brainerd Rd.
Tennessee, Knoxville 18: 4617 Old Central Ave. Pike
Tennessee, Memphis 4: 1530 Madison Ave.
Tennessee, Nashville 12: 4113 Hillsboro Rd.
Texas, Dallas 6: 6000 N. Central Expressway, P. O. Box 4776
Texas, Fort Worth: Suite 10, McKeever Bldg., 2509 W. Berry St.
Texas, Houston 1: 5440 Gulf Freeway, P. O. Box 2631
Texas, San Antonio 13: 2008 Military Dr. N. W.
Utah, Salt Lake City 15: 2280 So. Main St.
Washington, Richland 14: 1329 Geo. Washington Way
Washington, Seattle 9: 401 Pontius Ave.
Washington, Spokane 1: 917 West Mallon
Canada, Alberta, Calgary: 102 58th Ave. S. W.
Canada, Alberta, Edmonton: 10534 109th St.
Canada, B. C., Vancouver: 1128 Burrard St.
Canada, Nova Scotia, Halifax: 755 Barrington St.
Canada, Ontario, Ottawa 4: 1929 Bank St.
Canada, M. Winnepeg 12: 540 Roseberry St. St. James
Canada, Quebec, Montreal 28: 6277 Upper Lachine Rd.
Canada, Sask., Regina: Suite 511, 1791 Rose St.

Morris Machine Works, Baldwinsville, N. Y.
Illinois, Chicago 6: 205 W. Wacker Dr.
New York, New York 7: 50 Church St. Suite 1367
Ohio, Cleveland 34: 446 Leader Bldg.

Mission Manufacturing Co., 8760 Clay Rd., P. O. Box 4209, Houston 14, Texas

Mixing Equipment Co., Inc., 135 Mt. Read Blvd., P. O. Box 1370, Rochester 3, N. Y.

Mobile Drilling Inc., 960 North Pennsylvania St., Indianapolis 4, Ind.
Arkansas, North Little Rock: 322 W. Broadway
California, Los Angeles 22: 5350 E. Washington Blvd.
Colorado, Denver: 3301 Poplar St.
Florida, Jacksonville 7: 4652 Phillips Highway
Iowa, Cedar Rapids: 600 D Ave., N. W.
Maryland, Baltimore 12: 6301 Blackburn Court
Minnesota, St. Paul 14: 810 Cromwell Ave.
Missouri, Kansas City 14: 304 West 79th Street Terrace
Montana, Billings: 505 North 24th St.
Montana, Great Falls: 2322 River Drive
North Carolina, Greensboro: P. O. Box 1498, So. Elm St. Extension
North Dakota, Fargo: U. S. Highway 10 West
Washington, Seattle 4: 3838 4th Ave., South
Wisconsin, Milwaukee 3: 2404 W. Clybourn

Nachod & United States Signal Co., 4771 Louisville Ave., Louisville 9, Ky.
Utah, Salt Lake City: 375 South West Temple

Nagle Pumps, Inc., 1239 Center Ave., Chicago Heights, Ill.

National Filter Media Corp., 1717 Dixwell Ave., New Haven 14, Conn.
The National Filter Media Corp., 333 So. Third East St., P. O. Box 156, Salt Lake City, Utah
California, Alhambra: 20 South First St.
Illinois, Chicago 30: 6034 N. Cicero
Texas, Houston 3: 1607 Jefferson Ave.

National Iron Co. Ramsery St. at 50 Ave., W. Duluth 7, Minn.

National Malleable & Steel Castings Co., 10600 Quincy Ave., Cleveland 6, Ohio
National Malleable & Steel Castings Co., Capitol Foundry Division, Phoenix, Ariz.

National Mine Service Co., Koppers Bldg., Pittsburgh 19, Pa.
Illinois, Nashville
Kentucky, Ashland
Kentucky, Jenkins
Kentucky, Madisonville
Pennsylvania, Forty Fort
Pennsylvania, Greensburg
Pennsylvania, Indiana
West Virginia, Beckley
West Virginia, Logan
West Virginia, Morgantown
Canada, Elliot Lake, Ontario: National Mine Service (Canada) Ltd.

National Supply Co., 2 Gateway Center, Pittsburgh, Pa.
California, Torrance: 1524 Border Ave.
Colorado, Denver: 621 17th St.
Ohio, Toledo: 3320 Bishop St.

Naylor Pipe Co., 1243 East 92nd St., Chicago 19, Ill.
Georgia, Atlanta: 1468 Mecaslin St., N. W.
New York, New York 17: 60 E. 42nd St.
Ohio, Cleveland Heights 21: 2342 Noble Rd.
Pennsylvania, Philadelphia 7: Witherspoon Bldg.
Pennsylvania, Pittsburgh 22: 800 Keenan Bldg.

New York Engineering Co., 75 West St., New York, N. Y.

Nichols Engineering, 70 Pine St., New York 6, N. Y.
California, San Francisco: 405 Montgomery St.
Indiana, Indianapolis 1: 3513 N. Hovey St.
Canada, Montreal 25: 1477 Sherbrooke St. W.

Nordberg Manufacturing Co., 3073 S. Chase Ave., Milwaukee 1, Wis.
California, San Francisco 7: 674 Harrison St.
Minnesota, Duluth: Suite 600, Alworth Bldg., 306 W. Superior St.
Missouri, St. Louis 18: 3300 S. Second St.
New York, New York 17: Lincoln Bldg., 60 E. 42nd St.
Washington, D.C. 6: 609 Barr Bldg.
Canada, Toronto 1: 909 Concourse Bldg., 100 Adelaide St., W.

Northwest Engineering Co., 1509 Field Bldg., 135 S, LaSalle St., Chicago 3, Ill.
California, San Francisco 3: 255 Tenth St.
California, Vernon 58: 3707 Santa Fe Ave.
Washington, Seattle, 1234 Sixth Ave. South

Northern Blower Co., 6410 Barberton Ave., Cleveland, Ohio

Phelps Dodge Copper Products Corp., 300 Park Ave., New York 22, N. Y.
Alabama, Birmingham 5: 3524 Fourth Ave. South P. O. Box 2268
California, Los Angeles 22: 6100 South Garfield Ave.
California, San Francisco 5: Bank of America Bldg., 625 Market St.
Colorado, Denver 2: First Natl. Bank of Denver Bldg., 621 17th St.
District of Columbia, Washington 4: 207-9 National Press Bldg.
Florida, Jacksonville 2: Florida Title Bldg.
Georgia, Atlanta 3: 903 Candler Bldg.
Illinois, Chicago 3: 100 West Monroe St.
Indiana, Fort Wayne 1: 4400 New Haven Ave.
Indiana, Indianapolis 4: Circle Tower 5 East Market St.
Louisiana, New Orleans 12: 1009 Carondelet Bldg.
Massachusetts, Cambridge 39: 175 Albany St.
Michigan, Detroit 26: Mutual Bldg., 28 West Adams St.
Minnesota, Minneapolis 16: 110 Wood Excel. Bldg., 5009-A Excelsior
Missouri, Kansas City 11: 716 VFW Bldg., 406 West 34th St.
Missouri, St. Louis 3: Shell Bldg., 1221 Locust St.
New York, Rochester 7: 75 College Ave.
North Carolina, Charlotte 1: 213 West First St. P. O. Box 1802
North Carolina, Greensboro: P. O. Box 2643
Ohio, Cincinnati 2: Dixie Terminal Bldg., 49 East Fourth St.
Ohio, Cleveland 13: 1500 Terminal Tower Bldg., 50 Public Square
Ohio, Dayton 2: 1341 Third Natl. Bldg., 30-38 North Main St.
Oregon, Portland 9: 1436 N. W. 16th Ave.
Pennsylvania, Philadelphia 32: 3105 W. Allegheny Ave. P. O. Box 6843
Pennsylvania, Pittsburgh 22: 1522-23 Oliver Bldg., 535 Smithfield St.
Tennessee, Memphis 1: 903 Union Planters Natl. Bank Bldg.
Texas, Dallas 4: 3113 McKinney Ave.
Texas, Houston 3: 2922 Canal
Virginia, Richmond 21: 1000 Thompson St.
Washington, Seattle 1: 505 Skinner Bldg.
Wisconsin, Milwaukee 11: 2408 North Farwell Ave.

Philadelphia Gear Corp., G St., below Erie Ave., Philadelphia 34, Pa.
California, Gardena, P. O. Box 68
California, San Francisco 24: 1485 Bayshore Blvd.
Illinois, Chicago: 20 N. Wacker Dr.
Maryland, Baltimore: 4109 Westview Rd.
Massachusetts, Boston 94: 300 First Ave. (Needham Heights)
Minnesota, Minneapolis: 2644 34th Ave. South
New York, New York City 36: 330 W. 42nd St.
Ohio, Cleveland: 6333 York Rd.
Pennsylvania, Pittsburgh 19: 418 Frick Bldg.
Texas, Houston: 4902 Travis St.
Utah, Salt Lake City: 375 Southwest Temple St.

Philadelphia Quartz Co., 1135 Public Ledger Bldg., Philadelphia 6, Pa.
California, Berkeley 10: Philadelphia Quartz Co. of Calif., Seventh & Grayson Sts.

Pipe Linings, A Div. of American Pipe and Construction Co., P. O. Box 457, Wilmington, Calif.
Texas, Fort Worth: P. O. Box 1202

H. K. Porter Company, Inc. Leschen Wire Rope Div., 2727 Hamilton Ave., St. Louis 12, Mo.
California, Los Angeles 22: 6424 E. Fleet St.
California, San Francisco 7: 520 Fourth St.
Illinois, Chicago 7: 810 W. Washington Blvd.
New Jersey, Newark 5: 219 Emmet St.
Penna., New Kensington: 450 Second St.
Texas, Houston 3: 34 Jenkins St.
Washington, Seattle 4: 1041 Alaskan Way South

H. K. Porter Company, Inc., Refractories Div., Porter Bldg., Pittsburgh, Pa.
Alabama, Birmingham: 2800 Alabama, Bessemer
California, Los Angeles: 2946 East 44th St. Vernon 58
California, San Francisco: 1485 Bayshore Blvd.
Illinois, Chicago: 5 South Wabash Ave.
Missouri, St. Louis: 2064 Hampton Ave.
New York, New York: 300 Park Ave.
Pennsylvania, Philadelphia: Unruh & Milnor Sts.
Texas, Houston: 2712 Danville Rd. Office No. 107

Maryland, Baltimore 18: 2125-27 Maryland Ave.
Minnesota, Virginia: 204½ Chestnut

Div., 650 Fifth St. San Francisco 7, Calif.
Arizona, Phoenix: P. O. Box 6472—
California, Fresno: 2608 California Ave.
California, Los Angeles: 600 St. Paul Ave.
California, Sacramento: 1720 14th St.
Ohio, Cincinnati: Gwynne Bldg.
Ohio, Cleveland: 55 Public Square
Oklahoma, Tulsa: 703 Enterprise Bldg.
Oregon, Eugene: 1345 Olive St.

Plymouth Locomotive Works, Div. of the Fate-Root-Heath Co., Plymouth, Ohio

Raybestos-Manhattan, Inc. Manhattan Rubber Div., Passaic, N. J.
Alabama, Birmingham: 1108 North Fifth Ave.
California, Los Angeles: 4651 Pacific Blvd.
California, San Francisco: 168 Beacon St. South
Colorado, Denver: 4500 York St.
Illinois, Chicago: 6110 Northwest Highway
Minnesota, Minneapolis: 6113 Excelsior Blvd.
New York, New York: 500 Fifth Avenue
Ohio, Cleveland: 111 Center West Bldg., 20950 Center Ridge Rd.
Pennsylvania, Philadelphia: 1138 Suburban Station Bldg.
Pennsylvania, Pittsburgh: 810 Empire Bldg.
Washington, Seattle: 2450 Sixth Ave. South

Red Jacket Valve Co., Inc., 500M Bell Ave., Carnegie, Pa.

Riblet Tramway Co., Box 7, Station A, N. 1231 Washington St., Spokane, Wash.
Chile, Santiago: Casilla 13119

Ridge Tool Co., Elyria, Ohio

John A. Roebling's Sons Corp., Trenton 2, N. J.
California, Los Angeles 22: 5340 E. Harbor St.
California, San Francisco 1: 1740 17th St.
Colorado, Denver 16: 4801 Jackson St.
Georgia, Atlanta 10, 934 Avon Ave., S. W.
Illinois, Chicago 50: 5525 W. Roosevelt Rd.
Massachusetts, Boston 10: 51 Sleeper St.
Missouri, St. Louis 12: 5988 Minerva Ave.
New York, New York 6: 19 Rector St.
Ohio, Cincinnati 15: 2340 Glendale-Milford Rd. Evendale
Ohio, Cleveland 7: 13225 Lakewood Heights Blvd.
Oklahoma, Tulsa: 321 North Cheyenne St.
Pennsylvania, Philadelphia 6: 230 Vine St.
Texas, Houston 1: 6216 Navigation Blvd.
Texas, Odessa: 1920 East 2nd St.
Washington, Seattle 4: 900 First Ave., South

Rogers Bros. Corp., Albion, Pa.

Roots-Connersville Blower Div., 900 W. Mount St., Connersville, Ind.
Arizona, Phoenix: P. O. Box 6104
California, Los Angeles 58: 5120 Pacific Bldg.
California, San Francisco 5: 593 Market St., Room 610
Colorado, Denver 2: Denham Bldg.
District of Columbia, Washington 6: 828 Mills Bldg.
Georgia, Atlanta 5: 3166 Maple Dr., N. E., Room 212-214
Illinois, Chicago 26: 1737 West Howard St., Room 416
Massachusetts, Boston: 945 Great Plain Ave., Needham 92
Michigan, Dearborn 2: 4917 Schaefer Rd.
Missouri, Kansas City 12: 4706 Holly St.
Missouri, St. Louis 17: 2010 Big Bend Blvd.
Montana, Butte: P. O. Box 208
New York, Buffalo: 6045 Main St., P. O. Box 215
New York, New York 17: 122 E. 42nd St.
Ohio, Cincinnati 24: 5912 Hamilton Ave., P. O. Box 147
Ohio, Cleveland 15: 1900 Euclid Ave., Room 601
Oklahoma, Tulsa 14: 2821 South Florence Ave.
Oregon, Portland 22: 12200 S. E. Oatfield Rd.
Pennsylvania, Haverford: 357 Lancaster Ave., P. O. Box 506
Pennsylvania, Pittsburgh 19: Grant Bldg., Room 2411
Tennessee, Chattanooga 11: P. O. Box 8205
Tennessee, Elizabethton: 413 E. D St., P. O. Box 787
Texas, El Paso: Electric Bldg., Suite 511
Texas, Houston 10: 1619 Ovid St.
Utah, Salt Lake City 1: Continental Bank Bldg.
Canada, Toronto 3, Ontario: 629 Adelaide St.

Ross Screen & Feeder Co., 100 Quimby St., Westfield, N.J.
England, Surbiton, Surrey: Ross Engineers, Ltd., 11 Walpole Rd.

Sauerman Bros., Inc., 626 S. 28th Ave., Bellwood, Ill.

Service Supply Corp., 20th & Erie Ave., Philadelphia 32, Pa.

Simplex Wire & Cable Co., 79 Sidney St., Cambridge 39, Mass.
Arizona, Phoenix: 345 E. Pasadena St.
Georgia, Atlanta 3: 1231 Healey Bldg.
New York, New York 17: 100 Park Ave.
Ohio, Cleveland 14: Union Commerce Bldg.

Sheffield Div., Armco Steel Corp., Kansas City 3, Mo.
Arkansas, Little Rock: 801 Union Life Bldg.
Colorado, Denver: 130 E. 5th Ave.
Illinois, Chicago: 20 N. Wacker Dr.
Iowa, Des Moines: 819 Hubbell Bldg.
Kansas, Wichita: Koch Bldg., 321 W. Douglas
Louisiana, New Orleans: 703 Texas Co. Bldg.
Louisiana, Shreveport: 509 First National Bank Bldg.
Michigan, Detroit: 5-261 General Motors Bldg.
Minnesota, Minneapolis: 1455 Rand Tower
Missouri, Joplin: P. O. Box 1125
Missouri, Kansas City 25: Sheffield Station
Missouri, St. Louis: 10 S. Brentwood Blvd.
Missouri, Springfield: P. O. Box 1011, Southside Station
Nebraska, Omaha: 1012 W.O.W. Bldg.
New Mexico, Albuquerque: 142 Truman, N. E.
Oklahoma, Oklahoma City: 110 Classen Terrace Bldg.
Oklahoma, Tulsa: 201 KOME Bldg.
Oregon, Portland: McLaughlin Bldg., 1220 S. W. Columbia St.
South Dakota, Sioux Falls: 2412 S. Center Ave.
Texas, Dallas: 1820 Life of America Bldg.
Texas, Houston: 1309 C&I Bldg.
Texas, Lubbock: 722 Lubbock National Bank Bldg.
Texas, San Antonio: 310 Petroleum Commerce
Utah, Salt Lake City: Executive Bldg., 455 E. 4th St., South

Simplicity Engineering Co., Durand 4, Mich.

W. W. Sly Manufacturing Co., 4758 Train Ave., Cleveland 1, Ohio
Alabama, Birmingham 9: 28th Ave., So.
California, Los Angeles 22: 4645 E. Olympic Blvd.
California, San Francisco 24: 1485 Bayshore Blvd.
Colorado, Denver 2: 1732 Blake St.
Illinois, Chicago: 4753 N. Broadway
Indiana, Indianapolis: 5747 Allisonville Rd.
Massachusetts, Springfield 9: 94 Glen Oak Dr.
Michigan, Detroit 23: Room F-7, 18131 Fenkell Ave.
Minnesota, Minneapolis 4: 814 S. 9th St.
Missouri, St. Louis 10: 5015 Manchester Ave.
New Jersey, Jersey City: Room 711, Bergen Trust Bldg.
New York, Orchard Park: 140 East Quaker St.
Ohio, Cincinnati 6: 920 E. McMillan St.
Ohio, Cleveland 1: 4700 Train Ave.
Oregon, Portland 9: 625 Cascade Bldg.
Pennsylvania, Philadelphia 4: 114 South 40th St.
Pennsylvania, Pittsburgh 19: 524 Grant Bldg.
Texas, Houston: 6620 Dixie Drive
Canada, Ontario, Toronto 8: 2 Neville Park Blvd.

Smidth & Co., F. L., 11 West 42nd St., New York 36, N. Y.

Smit & Co., Anton, 111 Eighth Ave., New York 11, N. Y.

J. K. Smit & Sons, Inc., Murray Hill, N. J.
Connecticut, West Hartford 7: 208 Professional Bldg.
Illinois, Chicago 26: 1737 Howard St.
Michigan, Grosse Ile: 9105 Macomb Ave.
Ohio, Dayton 5: P. O. Box 97—Riverdale Station
Pennsylvania, Pittsburgh 19: Law & Finance Bldg.
Texas, Houston 23: 2034 Forrest Hill Blvd.
Wisconsin, Milwaukee 16: 6915 W. Capitol Dr.
Canada, Toronto 19: 81 Tycos Dr.

Sprague & Henwood, Inc., 221 West Olive St., Scranton, Pa.
Colorado, Grand Junction: New Fruita Highway

Spraying Systems Co., 3215 Randolph St., Bellwood, Ill.

Standard Machinery Co., 211 Bayshore Blvd., San Francisco 24, Calif.

Standard Oil Company of California, Western Operations, Inc., 225 Bush St., San Francisco 20, Calif.
Arizona, Phoenix: 311 N. Central Ave.
California, Fresno: Fulton-Fresno Bldg., Fulton & Fresno Sts.
California, Los Angeles: 605 W. Olympic Blvd.
California, Sacramento: 909—12th St.
California, San Francisco: 130 Sutter St.
Oregon, Portland: Pacific Bldg., 520 S. W. Yamhill St.
Utah, Salt Lake City: 164 South West Temple
Washington, Seattle: White-Henry-Stuart Bldg., 1318 Fourth Ave.
Washington, Spokane: Old National Bank Bldg., W. 422 Riverside Ave.
Hawaii, Honolulu: Alexander and Baldwin Bldg., 141 Merchant St.

Standard Steel Corp., 5001 South Boyle Ave., Los Angeles 58, Calif.

Stearns Magnetic Products, 635 S. 28th St., Milwaukee 46, Wis.
Illinois, Chicago 54: 7-113 Merchandise Mart Plaza
New Jersey, Fair Lawn: 12-94 Plaza Rd.

Stearns-Roger Manufacturing Co., P. O. Box 5370, 660 Bannock St., Denver 17, Colo.
Texas, El Paso: 708 Electric Bldg.
Texas, Houston: 1115 City National Bank Bldg.
Utah, Salt Lake City: 40 Richards St.
Canada, Alberta, Calgary: 330 9th Ave. W.

Stoody Co., 11930 East Slauson Ave., Whittier, Calif.

Straub Manufacturing Co., Inc., 8383 Baldwin St., Oakland 21, Calif.

Sturtevant Mill Co., 101 Clayton St., Boston, Mass.

Texas Co., 135 E. 42nd St., New York 17, N. Y.
California, Los Angeles 5: 3350 Wilshire Blvd.
Colorado, Denver 3: 1570 Grant St.
Georgia, Atlanta: 864 W. Peachtree St., N.W.
Illinois, Chicago 4: 332 S. Michigan Ave.
Indiana, Indianapolis 1: 3521 E. Michigan St.
Louisiana, New Orleans 16: 1501 Canal St.
Massachusetts, Boston 16: 20 Providence St.
Minnesota, Minneapolis 3: 1730 Clifton Pl.
Montana, Butte: 220 N. Alaska St.
New York, Buffalo 5: P. O. Box 368
New York, New York 17: 205 E. 42nd
Texas, Dallas: 1512 Commerce St.
Texas, Houston 2: 720 San Jacinto St.
Virginia, Norfolk 2: 3300 E. Princess Anne Rd.
Washington, Seattle 1: 1511 Third Ave.

Texas Gulf Sulphur Co., 75 East 45th St., New York 17, N. Y.
Texas, Houston

Thermoid Division, H. K. Porter Company, Inc., Tacony & Comley Sts., Philadelphia 24, Pa.
Timken Roller Bearing Co., 1835 Deuber Ave., S.W., Canton 6, Ohio

Tractomotive Corp., P. O. Box 632, County Line Rd., Deerfield, Ill.
Traylor Engineering & Mfg. Co., 1151 Mill St., Allentown, Pa.

Treadwell, M. H., 140 Cedar St., New York 6, N. Y.
California, San Rafael: 203 Las Flores
Illinois, Chicago 4: 208 S. LaSalle St.
Pennsylvania, Pittsburgh 22: 1015 Farmers Bank Bldg.

W. S. Tyler Co., 3615 Superior Ave., Cleveland 14, Ohio
California, Los Angeles 5: 3540 Wilshire Blvd.
California, San Francisco 4: Russ Bldg.
Georgia, Atlanta 3: Hurt Bldg.
Illinois, Chicago 2: 6 North Michigan Ave.
Massachusetts, Boston 16: Statler Bldg.
Minnesota, Minneapolis 9: 4915 1st Ave. So.
New York, New York 17: 750 Third Ave.
Pennsylvania, Philadelphia 7: Philadelphia Natl. Bank Bldg.
Texas, Dallas 1: Republic National Bank Bldg.
Utah, Salt Lake City 3: 351 Seventh Ave.

U. S. Rubber Co., 1230 Ave. of the Americas, New York 20, N.Y.
Arizona, Phoenix: 4025 No. Central Ave.
California, Los Angeles 58: Soto & East 46th Sts.
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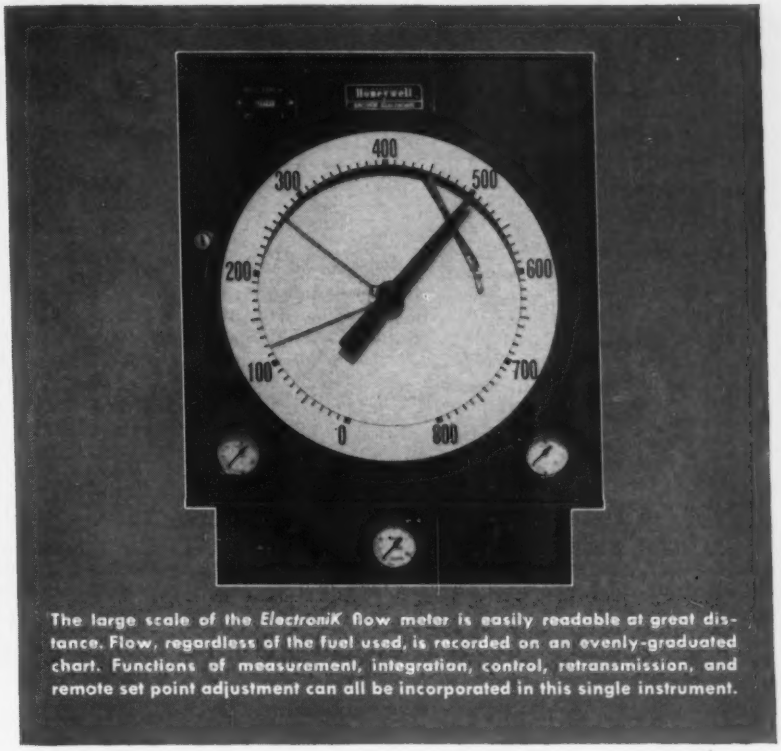

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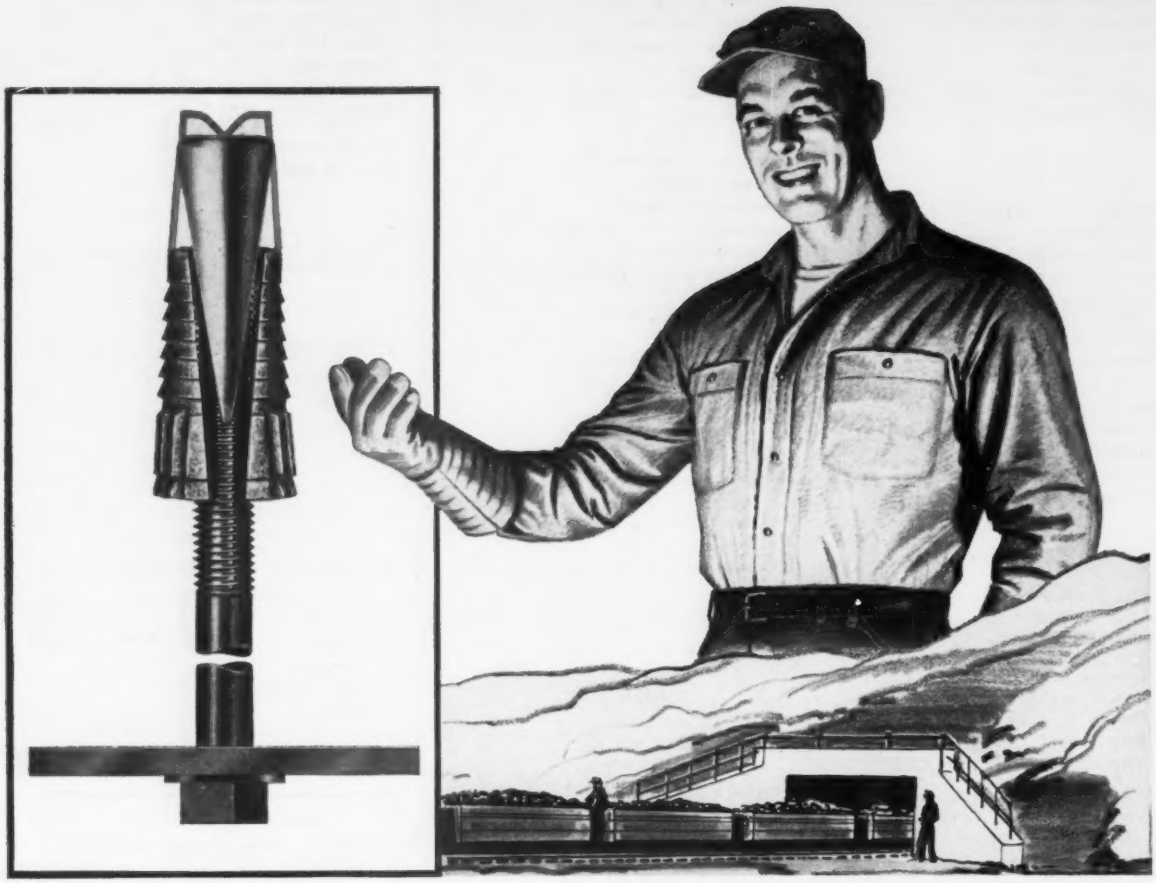

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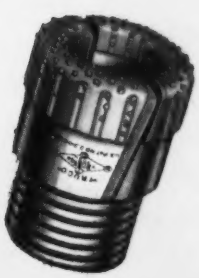

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